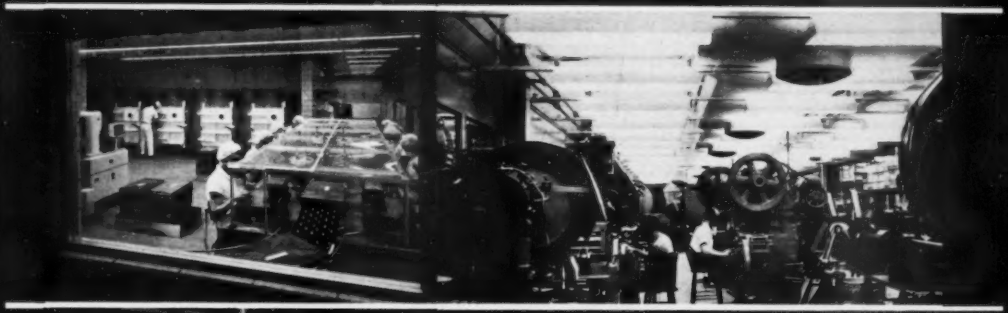
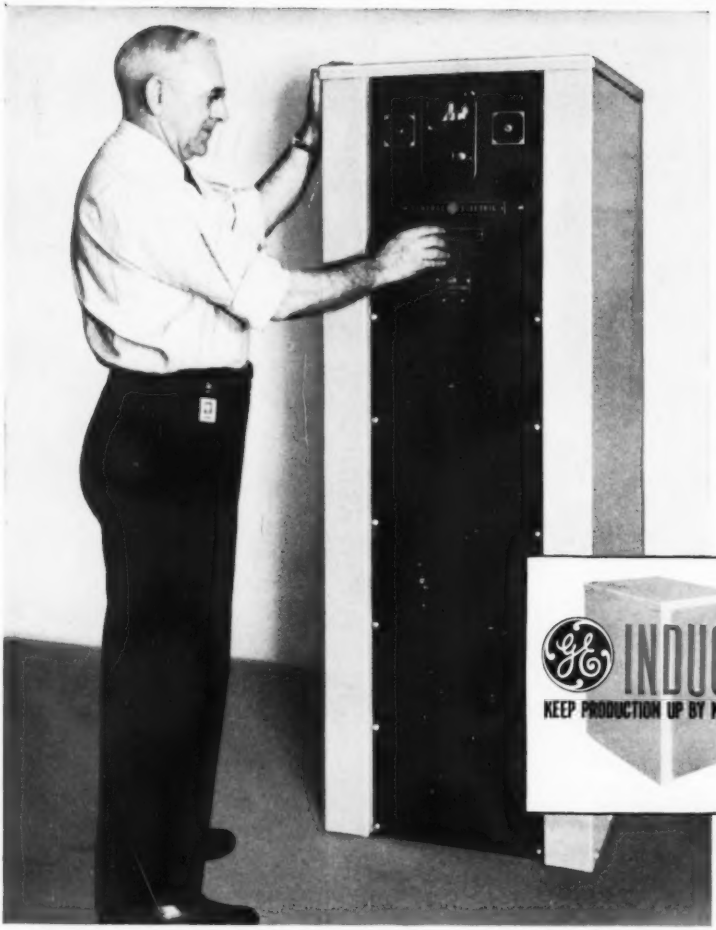
ELECTRICAL CONSTRUCTION AND MAINTENANCE



A McGRAW-HILL PUBLICATION 50TH YEAR



This new three-phase Inductrol gives you more kva of regulation in a smaller floor space than ever before.

General Electric's NEW INDUCTROLS

(dry-type induction voltage regulators)

will help you get out more production

Poor voltage can mean sluggish performance of electrical equipment—and reduced output. To be sure you are getting the motor performance and lamp brilliance you pay for, keep voltage up with General Electric's Inductrols.

New, improved Inductrols have been introduced this year for both single-phase and three-phase circuits, 600 volts and below. These new dry-type regulators automatically maintain correct voltage on your equipment. They do not require expensive fireproof vaults. The attractively styled all-steel cabinets completely enclose all live parts for greater safety. Standard automatic regulators are available for circuits ranging from 3 kva, 120 volts up to 500 kva, 600 volts.

For advice on how, when, and where to apply Inductrols, get in touch with your G-E sales representative or authorized agent.

Write for Bulletins GEC-712 and GEC-795. *General Electric Company, Schenectady 5, New York.*

404-81

GENERAL ELECTRIC

55 AMPERE CIRCUIT BREAKER SERVICE CONTROL
...ALWAYS CARRIES FULL LOAD

Another NEW Murray Product

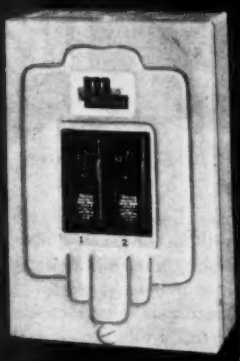
that gives you

Fully Magnetic

circuit protection

Fully Magnetic Circuit Breakers always carry their full rated load—never need derating. The magnetic principle of operation is not affected by changes in temperature.
Murray Breakers give three way circuit protection.

1. Timed delay to carry harmless overloads.
2. Timed tripping on dangerous overloads.
3. Immediate tripping on short circuits.



MANY ADVANTAGES

1. Fully Magnetic Circuit Protection.
2. Solderless connectors, and ample wiring room make it EASY TO INSTALL.
3. Seven concentric KO's—where you need them.
4. Easy to gang (no side handles).
5. Compact 7⅜" x 4⅞" x 3-11/16" (Surface type).
6. Also available in flush.

WHAT IS IT?

Service Control equipment with 55 ampere main capacity and two—50 ampere single pole Fully Magnetic Circuit Breakers. Supplied with handle extension for simultaneous manual tripping. Available in surface or flush. Listed by Underwriters' Laboratories, Inc.

HOW IS IT USED?

1. In place of a comparable 60 ampere fused switch.
2. As service entrance equipment.
3. As a main disconnect.
4. For protecting single phase lighting and appliance circuits or for fractional horse power motor circuits.
5. For protecting electric range circuits.
6. For use on 2 wire, 250 volt service without neutral or; 3 wire 125-250 volt wiring with neutral or 2 wire 125 volt with neutral.

IS IT AVAILABLE?

YES—Immediate shipment—see your electrical distributor or write the factory—specify catalog number LC002H.

One Of The Family

Another addition to Murray's growing Circuit Breaker equipment line. Others include—The 2 circuit 40 amp and 100 amp, the "6", the "8", the "12" and the "20" Circuit Protectors. Panel boards up to 42 branch circuits.

50 YEARS OF SERVICE TO THE ELECTRICAL INDUSTRY

For detailed information, write:

Murray®

MURRAY MANUFACTURING CORPORATION
1250 ATLANTIC AVENUE · BROOKLYN 16, N.Y.

Service Entrance & Meter Equipment · Magnetic Circuit Breakers · Switches · Current Limiting Reactors · Crows' Nest Aerial Ladders

The wall that can't be climbed!

A wall of brilliant light is a barrier no intruder can scale, no prowler can penetrate without exposure. Today, more than ever, this screen of protective lighting is a vital security measure, especially for plants engaged in defense work.

Appleton Floodlights are scientifically designed to guard industrial properties, while providing the good light necessary for best working conditions. The Elipso Standlite, for instance, rings your plant facilities with a broad band of illumination when properly spaced along a fence line or mounted on buildings.

For fixtures that meet every industrial requirement—including hazardous locations—whether indoors or out, contact Appleton, pace-setting manufacturer of electrical equipment for nearly half a century.

ELIPSO STANDLITE
Expertly designed to provide protection for industrial properties. Mounts on pole or wall.

DIFFUSO FLOODLIGHT
For even illumination of service stations, athletic fields, parking lots, etc. Pole, bracket or crossarm mounting.

SPORTO
For high intensity illumination over large areas. Weatherproof hood allows for complete vertical or lateral positioning. Pole, bracket or crossarm mounting.

APPLETON Floodlights

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

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Branch Offices: NEW YORK, 50 Church St. • DETROIT, 3049 E. Grand Blvd. • CLEVELAND, 1836 Euclid Avenue • SAN FRANCISCO, 655 Minna St. • ST. LOUIS, 227 Frisco Bldg. • LOS ANGELES, 100 N. Santa Fe Ave. • ATLANTA, 724 Boulevard, N. E. • BIRMINGHAM, 429 Brown-Marx Bldg. MINNEAPOLIS, 305 Fifth St., S. • PITTSBURGH, 414 Bessemer Bldg. • BALTIMORE, 100 E. Pleasant St. BOSTON, 10 High Street • DENVER, 1921 Blake Street • PHILADELPHIA, 1017 Cherry Street CINCINNATI, 626 Broadway • HOUSTON, 717 M. & M. Bldg. • HAVANA, Cuba, Malecon No. 9

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OUTLET BOXES AND SWITCH BOXES

ELECTRIC

INDUSTRIAL LIGHTING EQUIPMENT

PRODUCTS

EXPLOSION-PROOF FITTINGS AND FIXTURES

ELECTRICAL CONSTRUCTION AND MAINTENANCE

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

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OCTOBER 1951 • Vol. 50, No. 10

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Original 1500-kva single-ended G-E load-center substation installed on plant roof to conserve valuable floor space.

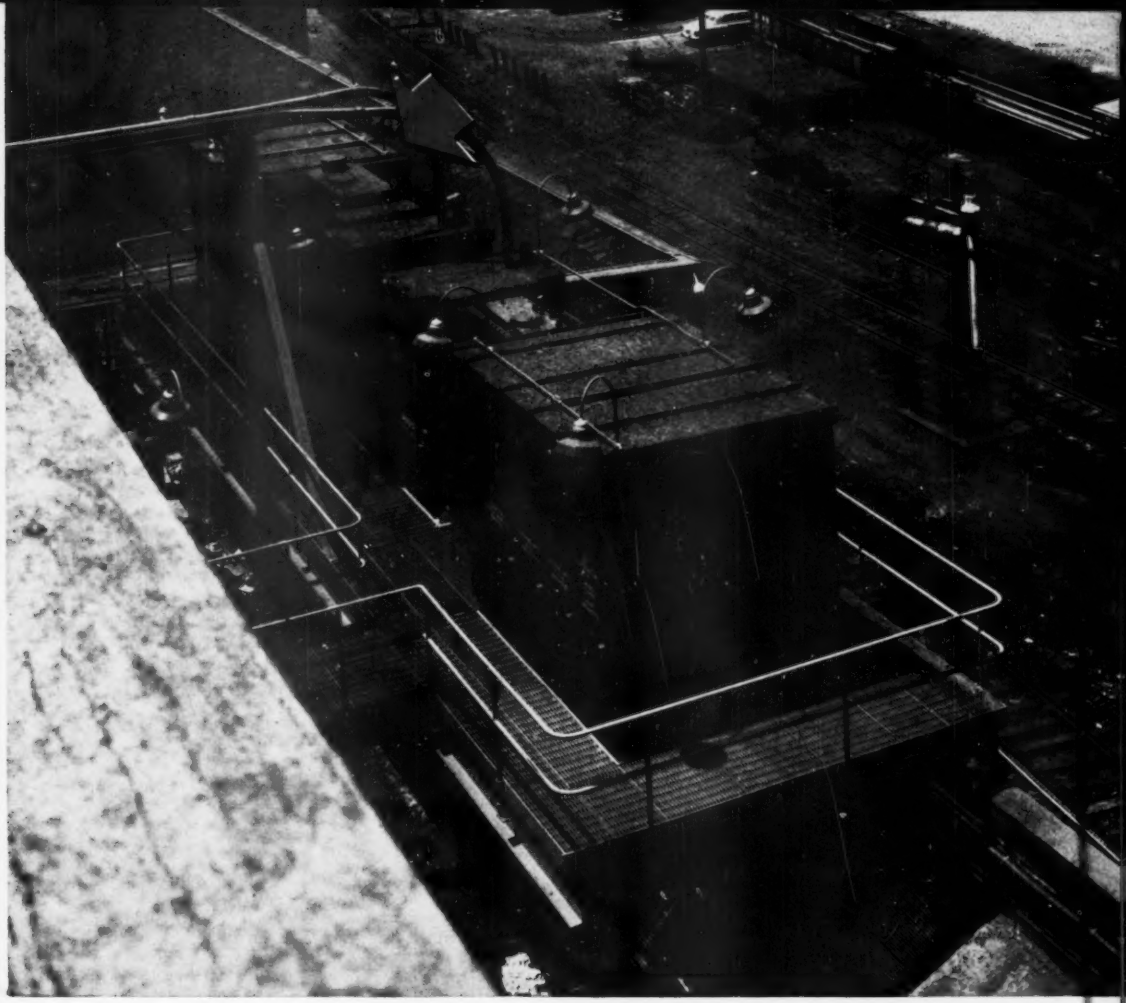
Foresight that paid off

POWER DISTRIBUTION SYSTEMS

Some time ago, an Eastern industrial put in a G-E load-center distribution system, knowing that the load served by one of its substations (above left) would probably double within five years. It actually doubled after *one* year.

With any other type distribution, the company would have eventually needed a bigger transformer, taxing the interrupting capacity of existing circuit breakers. Or had the original unit been twice needed size, investment would have been half-wasted for one year. Instead, the company waited until load doubled, then added another "building block" of power of the same economical size, keeping cost-per-kva at optimum. This load area is now fed by two 13,200-volt feeders, one to each transformer, for greater reliability.

What's more, the new substation was installed,



Recent addition of second 1500-kva substation, installed beside original one. Load area is now reached by two high-voltage feeders.

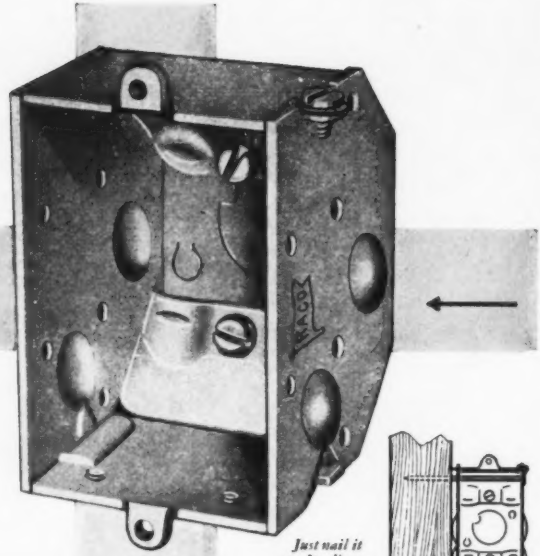
when power needs doubled

connected and energized without disrupting existing service. *Nothing already done was undone.* Your nearest G-E sales office can help you find the best way to distribute power in *your* plant during these years of expansion. *General Electric Company, Schenectady 5, N. Y.*

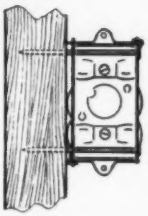
854-40

GENERAL ELECTRIC

THE **BUMPS** DO IT



Just nail it on. It aligns itself.

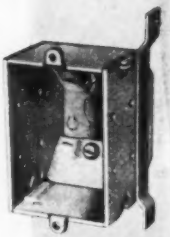


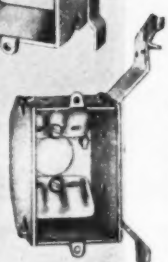
. . . when you nail these boxes directly on studding, they align themselves

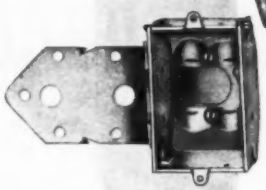
These Raco "economy" switch boxes fasten firmly to studding in new work simply by nailing through the holes provided. It's a fast mount. And you get perfect alignment because the levelling "bumps" have the added height and engineered spacing to line up the box with the studding in exact position. No danger of compressing the sides. Ears have been eliminated for economy.

And—an added Raco feature—the "straight-thru" nail holes are large enough for 16D nails.

This economy style is available in all types of switch boxes . . . all Raco quality, of course.







BRACKET TYPE BOXES

FLAT BRACKET
—this is a sturdy bracket which allows the box to be adjusted to all wall thicknesses.

SIDE MOUNT
—a new bracket on a nationally popular box, especially formed for door frame clearance. The bracket is gauged for standard wall thickness. "Break-off" gauges allow adjustment to all wall thicknesses.

FACE MOUNT
—a newly redesigned bracket, with rounded safety-style corners. Bracket is also equipped with nailing prongs.

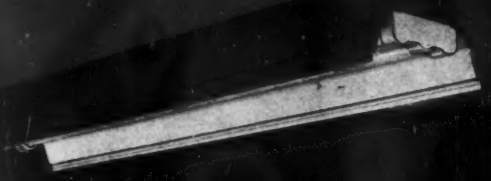
RACO

ALL-STEEL PRODUCT

There's a RACO Bracket Mount Box for Every Job

ALL-STEEL EQUIPMENT Inc.—800 Kensington Ave., Aurora, Illinois

YOU CAN ALWAYS RELY ON RACO



FOR LIGHTING TODAY
... and Tomorrow Too!

RLM
ELECTRICAL TESTING LABORATORIES, INC.

PHILITE

Ruby-Philite Corp.
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You Need This New Ruby-Philite Catalog of RLM Industrial Lighting Fixtures

SEND FOR IT TODAY!

FOR FLEXALUM APPROVED SLIMLINE AND FLUORESCENT COMMERCIAL FIXTURES, REQUEST CATALOG No. 50—SECTIONS "A" & "B". FOR INCANDESCENT COMMERCIAL LIGHTING FIXTURES AND BULLETS, REQUEST CATALOG No. 50 — SECTION "C".

Approved by UNDERWRITERS LABORATORIES

YES, the PENN-UNION Connector TAKES THEM ALL-

LARGER SURFACES for the WRENCHES ~ a good-sized HEX Top and Bottom

The men who use connectors appreciate the *better design* of the Penn-Union - - especially when they have to make a splice in close quarters, or any unhandy location.

Better Design is a feature of the entire Penn-Union line, which includes Tees and Taps, Straight Connectors, Terminals, Grounding Clamps, and many more fittings . . . every one thoroughly dependable, mechanically and electrically. *Preferred by leading users,* who have found that "Penn-Union" on a fitting is their best guarantee of unfailing service.

Far More in use than any other

Sold by Leading Wholesalers

PENN-UNION ELECTRIC CORPORATION, Erie, Pa.

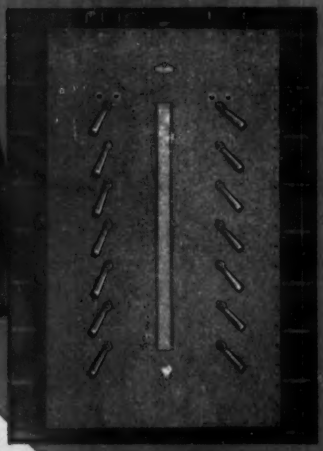
Canada: Dominion Cutout Company, Ltd., 250 Richmond St. West, Toronto

The **Complete** *Line of Conductor Fittings*

PENN-UNION

Where DUST is a HAZARD

INSTALL FA DUSTITE PANELBOARDS



Above is a typical FA DUSTITE feeder panelboard, and below a FA DUSTITE Lighting panelboard. Both are Underwriters Laboratories' approved for Class II, groups E, F, & G, Hazardous locations.

Similar vapor-proof (not explosion proof) type panelboards are also made by FA

Here's maximum protection where volatile dust presents a hazard in the distribution of power and light. Regardless of external dust conditions, FA DUSTITE Panelboards provide safe, dependable performance because *they are dust-free inside.*

Dust is sealed out by means of welded hubs for conduit outlets . . . welded box corners . . . external mounting brackets . . . and a solid steel front plate with gasket protection all around.

FA Dustite panelboards are of the automatic circuit breaker type, which provide protection without a need for replacement of any parts. Circuit breakers are externally-operated by a Dustite mechanism of FA design. Handles operate through dustite bushings and engage the handle of the circuit breaker *inside* the cabinet. ON, OFF and TRIPPED positions are indicated on the front of the cabinet.

So don't take chances where dust is a hazard. Install an FA DUSTITE Panelboard. Should you want additional information, contact your nearest FA representative, listed in Sweets, or write for bulletin No. 302.

Capacities of FA DUSTITE Panelboards are 15 to 600 amps, 250 volts AC or DC and 600 volts AC main lugs only, or main circuit breaker.

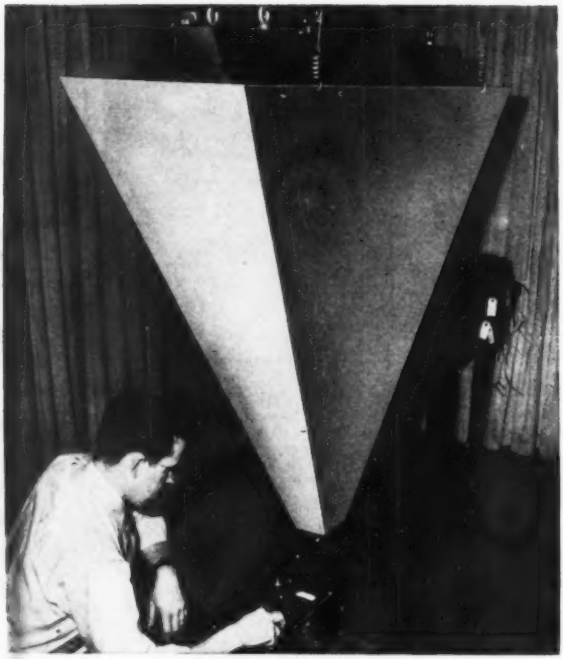
Frank Adam Electric Co.

P. O. BOX 357 ST. LOUIS 3, MO.

Makers of BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

Our 60th Year

MINIMIZE NOISE COMPLAINTS with G-E SOUND-RATED* BALLASTS



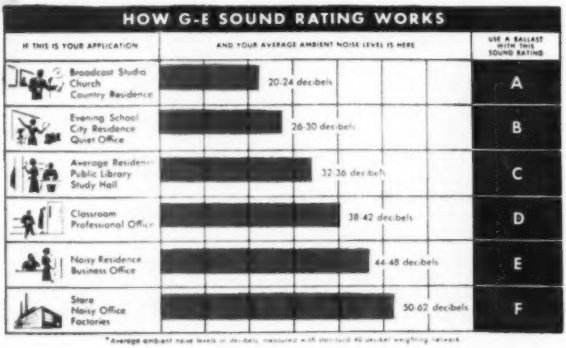
G-E engineer puts ballast through series of rigid tests. Constant attention to sound levels by G.E. helps you minimize the noise problem.

*SOUND-RATING: G.E.'s new classification of ballasts to guide you in the correct application of fluorescent fixtures.

A new tool to help you build greater customer satisfaction

Every fluorescent ballast has a normal, magnetic hum. But now, for the first time, you can know the relative sound level of the ballast before you buy. For G-E engineers have pioneered a system for measuring ballast sound levels accurately. These measurements have led to six classifications: from "A"—extremely quiet, to "F"—quite audible. This means that you know, before installation, which ballasts are right for any given application—whether it be church, school, noisy factory area, or any one of a wide range of other locations.

Take the first step toward eliminating customer complaints about objectionable noise. Write for GEA-5672, a four-page bulletin which explains Sound Rating in detail. A reprint of recent technical information (GER-366) is also available. Write Section 412-94, General Electric Co., Schenectady 5, N. Y.



GENERAL ELECTRIC

412-94

Your logical SOURCE
—for all tape requirements!

Good workmanship in wiring calls for good materials. Make certain of tape quality by using the tape that's made with 30 years experience behind it!

ACCURATE TAPES

...for every INSULATING need!

ACCURATE RUBBER TAPE

Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M.-A.A.R. grades.

ACCURATE FRICTION TAPE

High grade rubber carefully compounded with finest cotton base provides maximum mechanical protection for every wrap. Made in Standard and A.S.T.M. grades.

ACCURATE
Plastic Tape

Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.

...no finer tapes at any price!

For big wiring jobs or small, Accurate is the choice for positive tape protection. Both friction and rubber are strong, pliable, easy to apply. Accurate tapes make accurate wraps — pull tight and clean over irregular surfaces. When you order tape, mention Accurate by name. It's the one sure way to complete tape satisfaction. For a complete guide to tape selection and tape buying, ask for the new Accurate Data Folder. Accurate Mfg. Company, Garfield, New Jersey — address inquiries to Dept. B.

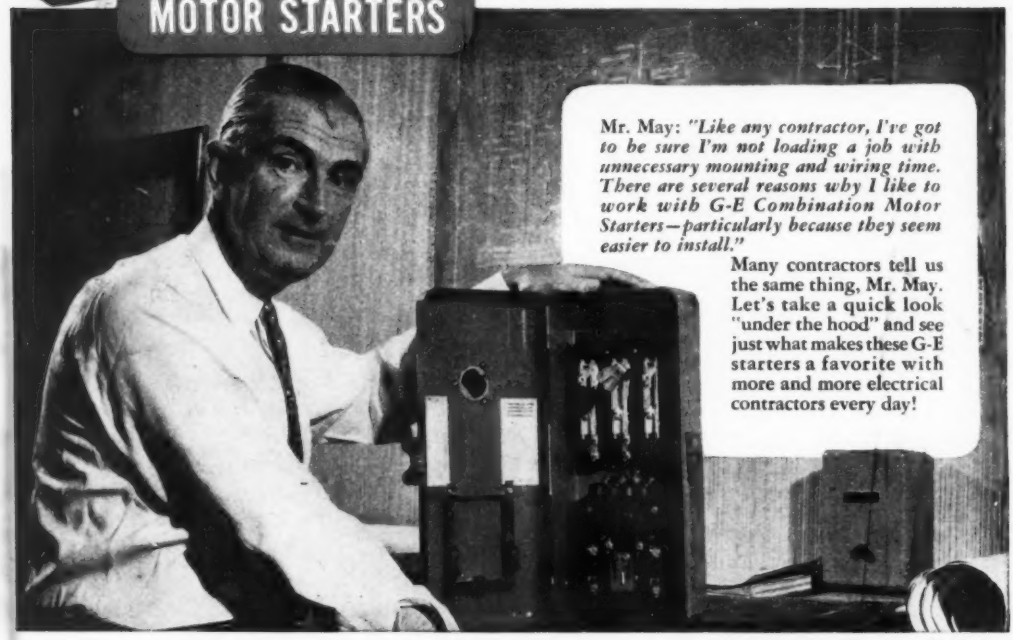
amc

MORE THAN A QUARTER CENTURY OF TAPE SPECIALIZATION

...save wiring

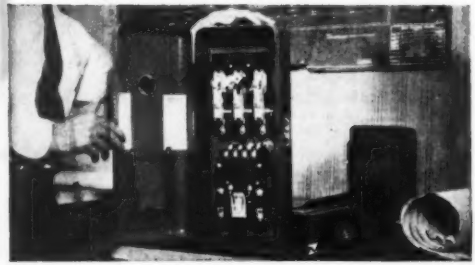
E. G. MAY, ELECTRICAL CONTRACTOR,

COMBINATION MOTOR STARTERS

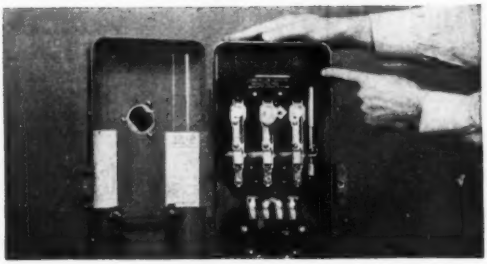


Mr. May: *"Like any contractor, I've got to be sure I'm not loading a job with unnecessary mounting and wiring time. There are several reasons why I like to work with G-E Combination Motor Starters—particularly because they seem easier to install."*

Many contractors tell us the same thing, Mr. May. Let's take a quick look "under the hood" and see just what makes these G-E starters a favorite with more and more electrical contractors every day!



1 Mr. May: *"Suppose we start with the mounting. There's a real time-saver!"*
That's right, Mr. May. Both starter and disconnect switch are mounted in one case. Thus, they're installed as a unit! You save wiring time and your customer gets a neater installation!



2 Mr. May: *"Wiring room is mighty important to a contractor."*
Then you should like the layout of this starter. There's plenty of room at top and bottom for line and load wiring. Of course, we take care of wiring the disconnect switch to the starter at the factory.

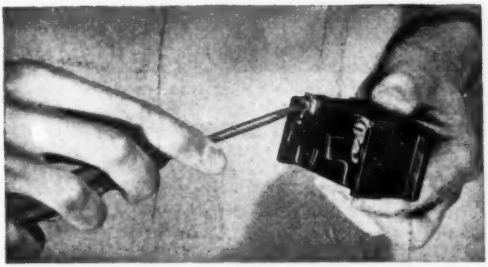
GENERAL ELECTRIC

730-24

time for these 4 reasons

REVEALS THE "REASONS WHY" HE PREFERS G-E COMBINATION STARTERS

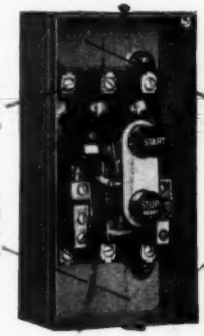
3 Mr. May: *"Having these terminals up front makes them easy to work with!"* Remember, too, you're working with large pan-head screws. All you do is strip the wires, slide them under the terminal clamps which ride out with the screws, and then tighten. All terminals are big, rugged and permanently anchored.



4 Mr. May: *"I've heard a lot about this coil. What's so different about it?"* It's completely encased in plastic—so that neither you when installing the starter, nor your customer when servicing it can damage the coil with a slipping screwdriver; and you can assure your customers that these "Strong Box" coils last longer because water, dust and oil are *sealed out!*

G-E Manual Starters ...easier to install, too!

For manual starting of 7½ hp or smaller motors, you can't beat a G-E starter for easy installation, long life. Built to the same rugged specifications as the magnetic starter, it includes many of the same features for quick-wiring:


Front-connected clamp-type terminals up front!
Three-point keyhole mounting.
Plenty of wiring space and straight-through wiring.
Handy knock-outs in top, bottom and sides.

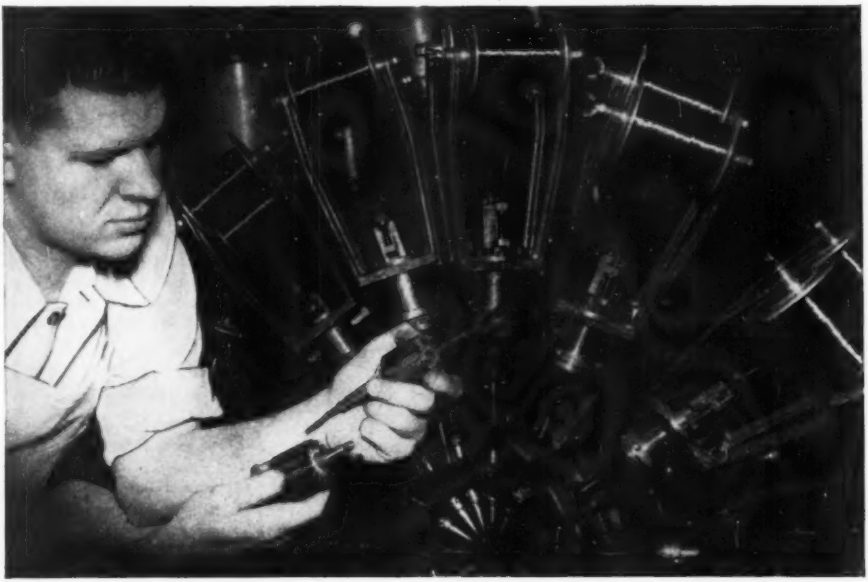
These starters are available with either push-button or toggle-switch operation, and can also be obtained in water-proof, dust-proof, or explosion-proof enclosures . . . 2-, 3-, or 4-pole forms.

G.E. also offers a complete line of control accessories to make operations more automatic . . . more convenient.

BUY ONE AND COMPARE!

Take any G-E motor starter apart and inspect it. See for yourself why G-E starters last longer, cost less to install, and are easier to maintain than any starters you can buy. Your G-E representative or authorized distributor can supply many models of G-E starters in NEMA sizes 0, 1, 2, and 3 for motors up to 50 hp; anticipate your requirements and place your order early. For more information on magnetic starters, write for Bulletin GEA-5153; manual starters, Bulletin GEA-1522. Section 730-24, *General Electric Company, Schenectady 5, N. Y.*

MAGNET WIRE



You'll get superior results and save money with ROEBLING ROEVAR

YOU GET a whole group of special advantages with Roebling Roevar Magnet Wire. For one thing, it doesn't tend to become brittle, crack or lose its toughness when subjected to relatively high operating temperatures. For another, Roevar's insulation has from 10 to 40 times more abrasion resistance than ordinary enamel insulation. It has no equal for high speed winding. And Roevar stretches and bends remarkably without cracking or working loose from the conductor. It has a better-than-average space factor.

A large share of Roebling's complete line of electrical wires and cables is required today in the national rearmament program, but the Roebling organization will always do everything possible to meet your individual service and delivery requirements. John A. Roebling's Sons Company, Trenton 2, New Jersey.

ROEBLING

Atlanta, 934 Avon Ave ★ ***Boston,*** 51 Sleeper St ★ ***Chicago,*** 5525 W. Roosevelt Rd ★ ***Cincinnati,*** 3253 Fredonia Ave ★ ***Cleveland,*** 701 St. Clair Ave, N.E. ★ ***Denver,*** 4801 Jackson St ★ ***Detroit,*** 915 Fisher Building ★ ***Houston,*** 6216 Navigation Blvd ★ ***Los Angeles,*** 216 S. Alameda St ★ ***New York,*** 19 Rector St ★ ***Odessa, Texas,*** 1920 E. 2nd St ★ ***Philadelphia,*** 230 Vine St ★ ***San Francisco,*** 1740 17th St ★ ***Seattle,*** 900 1st Ave, S. ★ ***Tulsa,*** 321 N. Cheyenne St ★ Export Sales Office, ***Trenton, N. J.***

Stadium Lighting Installation—Pole base mechanism permits 3-ganged cutouts to be switched from ground.

Combine fuse protection with "disconnect-under-load"

Low-cost G-E oil fuse cutouts give you both

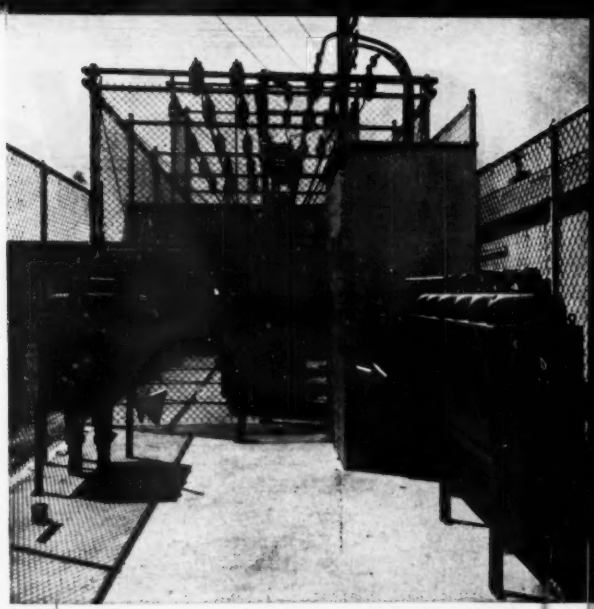
In the G-E oil fuse cutout all arcing occurs under oil when the fuse blows or when switched. The housing, with its drawn steel tank threaded into cast-iron cover, is liberally designed for safety: withstanding internal pressures well in excess of those that can occur at the cutout's interrupting rating. There are no exposed live parts—whether the cutout is in open or closed position—and no expulsion of arc flame.

Special arcing surfaces on the heavy self-aligning contacts keep load-carrying surfaces clean—make it possible to use these cutouts repeatedly as switches to open circuits under loads.

Suitable for both utility and industrial applications, these cutouts are—

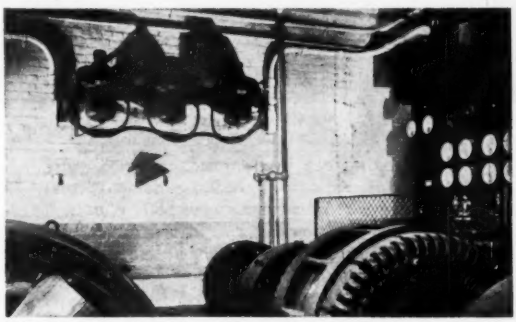
1. **Available for 2400-, 4160-, and 7200-volt circuits, current ratings up to 300 amperes; interrupting ratings up to 11,000 amperes.**
2. **Ideal for indoor mounting, vault or subway mounting and outdoor pole or wall mounting.**
3. **Available in metal enclosed assemblies, single or three-phase, rack or wall mounted, and providing for cable, conduit, or pothead connections.**
4. **Provided with switching mechanisms for single- or three-phase switching and pole base operation on rack-mounted or metal-enclosed units.**

Full information can be found in Bulletin GEA-732—available through your G-E Apparatus Office, or by writing, *General Electric Company, Schenectady 5, New York.*



Outdoor Substation Installation—Metal enclosed assembly avoids exposure of cable entrances and gang-operated mechanism provides for simultaneous switching.

Subway Installation—Expansion chambers attached to cutouts permit complete submersion.



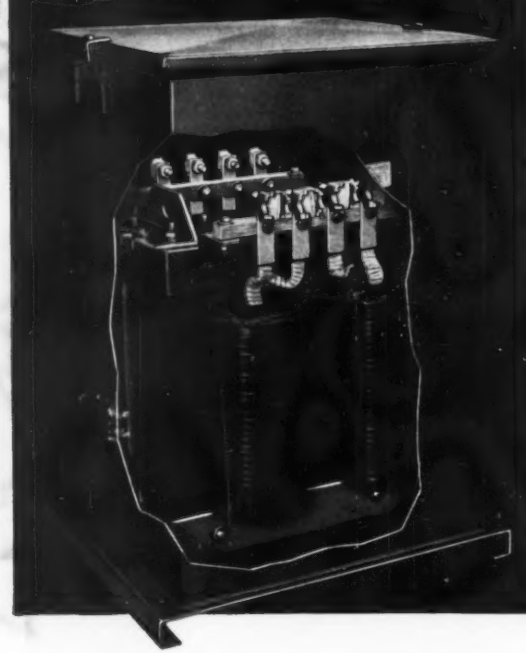
Indoor Substation Installation—Oil cutouts in incoming lines provide high current fusing.

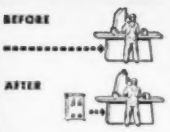
406-40

GENERAL ELECTRIC

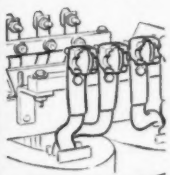
Cut Waste Power!

ALLIS-CHALMERS Dry-Type Transformers

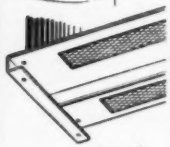




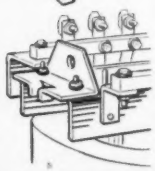
ELIMINATE long runs of secondary copper . . . save through reduced power consumption, improved machine and lighting efficiency, increased system flexibility, lower cable installation costs.



TIME-SAVING solderless connectors are standard on units 15 through 50 kva, single phase, and 37½ through 100 kva, three phase. On larger sizes, flat drilled bars are arranged vertically for any connector.



RAPID THRU-DRAFT ventilation is obtained by air inlet through base and outlet through cover overhang. Natural chimney draft action draws air through vertical air ducts in coils. Class B insulation used throughout.



BUILT for hard service. Sturdy side frames retain alignment and rigidity of core and coil structure. Case is all-welded, *Spra-Bonderized*, receives 3 coats of baked-on resilient paint.

LOOKING FOR WAYS to cut production costs? Here's a tip — check for below-normal voltages at lamps, motors and heating loads.

Did you know that a 10% correction in voltage will recover a 30% illumination loss? . . . 20% motor starting torque loss? . . . 19% output loss in heating operations?

To side-step these losses and get the most out of your power bill, install Allis-Chalmers "dry-types" right at loads. You'll 1) improve voltage regulation for better lamp, motor, and thermal efficiency; 2) make added savings through reduced line losses.

And they're easy to mount. Put them on overhead platforms, machines, posts or walls. No firewall needed.

Transformers are stocked country-wide in popular ratings. For information and bulletin 61B6382A contact your A-C Dealer or A-C Sales Office. A-3025

ALLIS-CHALMERS, 930A SO. 70 ST. MILWAUKEE, WIS.

ALLIS-CHALMERS

E.T.L. REPORTS

. . . of this WM. PENN PENDANT-MOUNTED FLUORESCENT LUMINAIRE

The test shows

the Coefficients of Utilization as listed in the column to the right.

of this WM. PENN VERSATILE FIXTURE

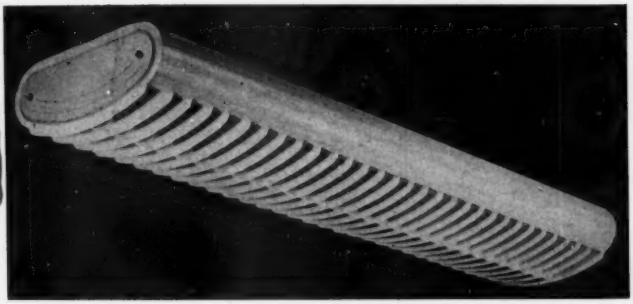
The test shows

another report on Coefficients of Utilization as found by the Electrical Testing Laboratories, Inc.

These E.T.L. Reports speak for themselves . . . tell the story!

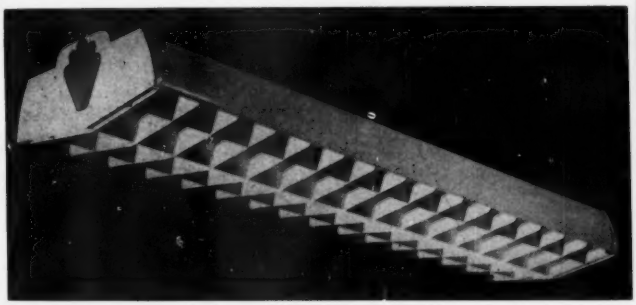
Wm. Penn Fixtures have exceptional lustrous which make for easy installation and long lasting efficiency. Made of heavy gauge steel with the enamel baked on, these fixtures have been tried and proved. Illustrated are only two of the many types of luminaires. A more complete listing may be found in our new catalog or in Sweets Architectural File. Write today and your inquiry will receive prompt attention.

Tell the . . . School Lighting Story



Coefficients of Utilization for
Cat. No. 2/40 106 Two 40-Watt Fluorescent Luminaire

Ceiling	75%			50%			30%	
Walls	50%	30%	10%	50%	30%	10%	30%	10%
Room Index	Coefficients of Utilization							
J 0.6	0.31	0.27	0.25	0.28	0.25	0.23	0.24	0.22
I 0.8	0.38	0.34	0.32	0.34	0.31	0.29	0.29	0.27
H 1.0	0.42	0.38	0.36	0.37	0.35	0.33	0.32	0.30
G 1.25	0.46	0.43	0.40	0.41	0.38	0.36	0.35	0.33
F 1.5	0.49	0.45	0.42	0.43	0.40	0.38	0.37	0.35
E 2.0	0.53	0.49	0.47	0.47	0.44	0.42	0.40	0.38
D 2.5	0.57	0.53	0.50	0.50	0.47	0.45	0.42	0.41
C 3.0	0.59	0.55	0.52	0.52	0.49	0.46	0.44	0.42
B 4.0	0.63	0.59	0.56	0.54	0.51	0.50	0.46	0.44
A 5.0	0.64	0.61	0.58	0.56	0.53	0.51	0.47	0.46



Coefficients of Utilization for
Cat. No. 2/40 School Lite Two 40-Watt Fluorescent Luminaire

Ceiling	75%			50%			30%	
Walls	50%	30%	10%	50%	30%	10%	30%	10%
Room Index	Coefficients of Utilization							
J 0.6	0.33	0.29	0.27	0.30	0.28	0.26	0.27	0.25
I 0.8	0.39	0.36	0.35	0.37	0.34	0.33	0.33	0.31
H 1.0	0.43	0.41	0.39	0.40	0.38	0.37	0.36	0.35
G 1.25	0.47	0.44	0.43	0.43	0.41	0.40	0.39	0.38
F 1.5	0.49	0.47	0.45	0.45	0.43	0.42	0.41	0.40
E 2.0	0.53	0.51	0.48	0.49	0.47	0.45	0.44	0.42
D 2.5	0.57	0.53	0.51	0.52	0.49	0.48	0.46	0.45
C 3.0	0.59	0.56	0.53	0.53	0.51	0.49	0.47	0.46
B 4.0	0.61	0.58	0.56	0.55	0.53	0.52	0.49	0.48
A 5.0	0.62	0.60	0.58	0.56	0.54	0.53	0.51	0.49

Wm. PENN FLUORESCENT LIGHT MFGR.
1429 S. 23rd STREET. PHILA. 46, PA.

why accept less?

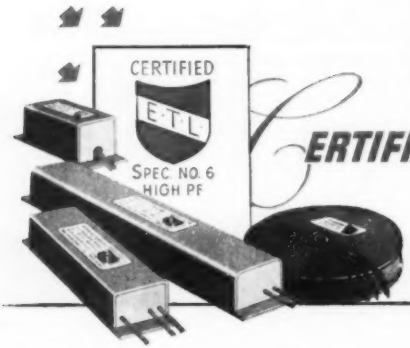
assure a full 100% life for fluorescent tubes!

- Tests show that fluorescent lamps last longer when used with a CERTIFIED BALLAST than when connected with an improperly designed ballast.

CERTIFIED BALLASTS assure rated light output, quiet operation and long, satisfactory service. There's a reason for this. It is... CERTIFIED BALLASTS are made to precise specifications, then tested, checked and *certified* by Electrical Testing Laboratories, Inc.

● Complete information on the types of CERTIFIED BALLASTS available from each participating manufacturer may be obtained from Electrical Testing Laboratories, Inc., East End Avenue at 79th Street, New York, New York.

Participation in the CERTIFIED BALLAST program is open to any manufacturer who complies with the requirements of CERTIFIED BALLAST MANUFACTURERS.



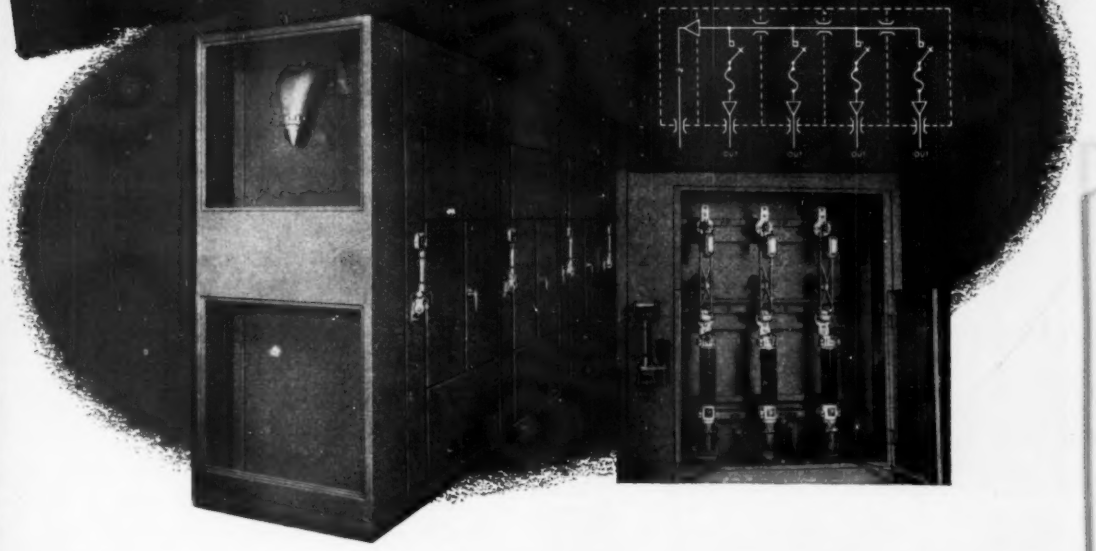
CERTIFIED BALLAST MANUFACTURERS

Makers of Certified Ballasts for Fluorescent Lighting

2116 KEITH BLDG., CLEVELAND 15, OHIO

WANT TO *Save Money* on high voltage switchgear?

50%



More production... more machinery... more use of electricity in your plant... and presto! your distribution system is no longer adequate. Modernization using load center distribution is the answer. This may involve increasing the size of, or installing additional load centers.

Also it is pretty certain that the capacity of the system serving you has increased, so you need added interrupting capacity in your protective equipment. Here's where you should know about S&C Switchgear Units for substations and load centers, because they're modern and will save you plenty of money over circuit breakers.

Typical Performance Characteristics of S&C Switchgear Units

	VOLTS 2,300 to 34,500	SHORT CIRCUIT PROTECTION
	AMPERES	Expressed in 3-Phase KVA
Switches:	600, continuous and interrupting	180,000 at 4,160 volts
Fuses:	400, continuous, to 15,000 volts	448,000 at 13,800 volts
	300, continuous, to 34,500 volts	715,000 at 33,000 volts

Utilizing Alduti Interrupter Switches and SM Power Fuses (Solid Boric Acid), S&C Switchgear Units give the switching performance and short-circuit protection described below, left. In addition they provide:

One-package (unitized) metal-enclosed construction.

Ease and economy of installation because all equipment within each unit is factory assembled and connected. Incoming and outgoing connections are readily accessible.

Minimum maintenance expense since a blown fuse is fully restored by simple field replacement of its refill unit. Moreover, under usual conditions the switch requires no maintenance.

Service continuity since the reliability of S&C Power Fuses eliminates outages from surge-caused "sneakouts".

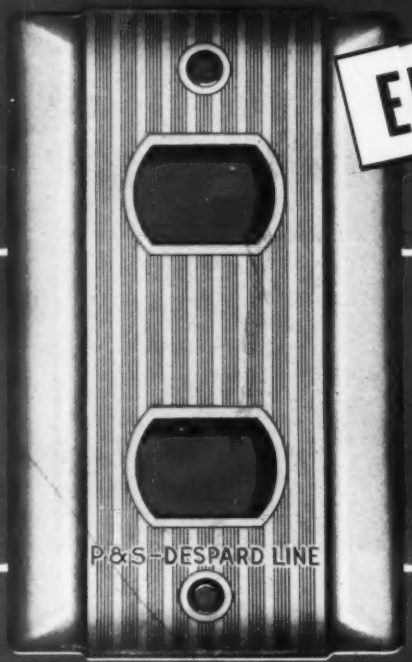
48-page descriptive booklet is yours for the asking. Consult telephone directory for S&C representative or write us direct.

S&C ELECTRIC

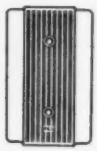
Powerlite

P&S Announces A

ENTIRELY NEW



Gracefully Contoured . . . Refreshingly Simple . . . At home in any decorative scheme—modern or conventional.



A Complete Line carrying out this attractive and distinctively new basic design by P&S—the originators of UNILINE.

Brown and Ivory bakelite—for use with all P&S and P&S-Despard devices —single and multi-gang—a complete wall plate set-up for a matched installation.

Catalog numbers remain the same. Continue to specify the familiar "91000" and "92000" series.

Shipments of new design start in October.

Simplify your stocking problem by standardizing on this complete, matched line.

All plates comply with Federal and REA Specifications.

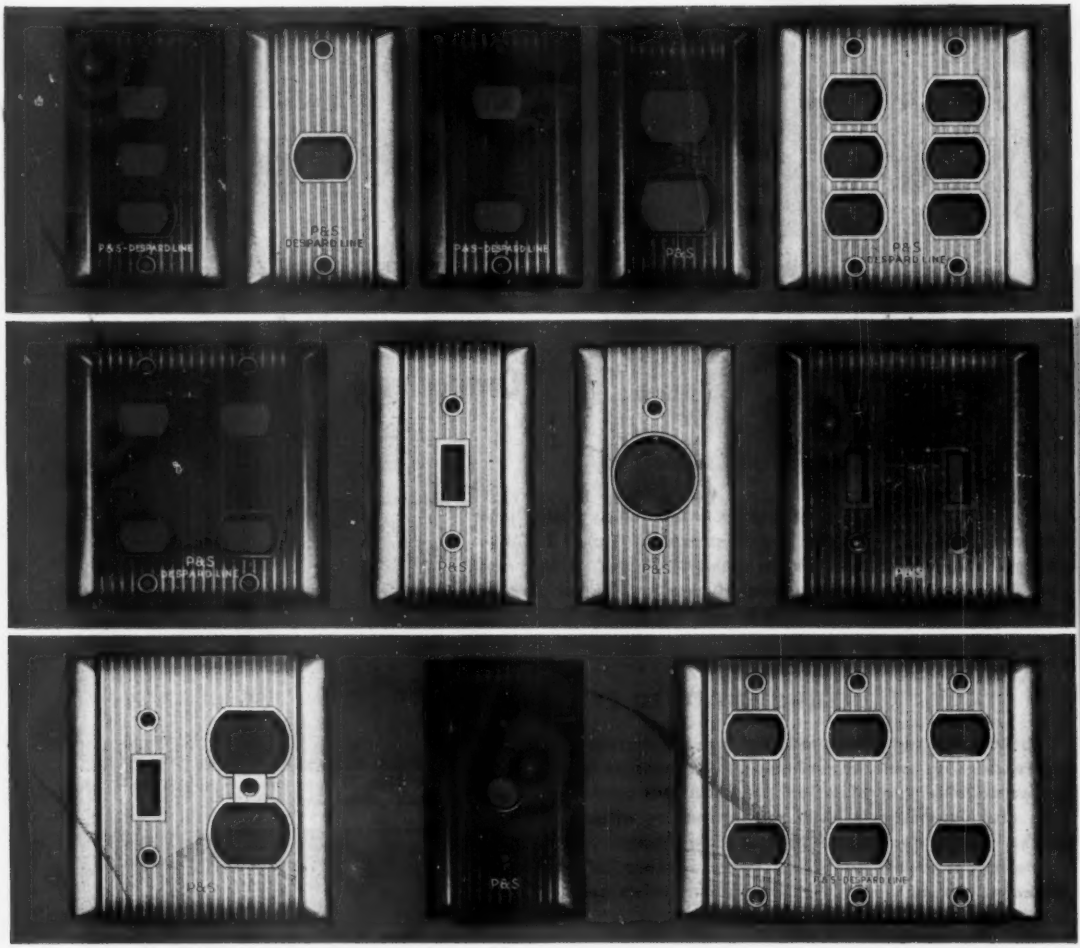
Basic design registered
U.S. Patent Office
No. Des. 154,372

P&S®

UNILINE
TRADE MARK

PASS & SEYMOUR INC.
SYRACUSE 9, NEW YORK

New UNILINE Design



MAIL THIS COUPON *Today!*

Yours for the asking—folder illustrating and describing in detail the new P&S Line of Uniline Plates. Coupon is for your convenience. Fill in and mail today without fail.

Pass & Seymour, Inc.
Dept. M
Syracuse 9, New York

Send folder on new P&S Uniline Plates

_____

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Please print plainly

ORANGEBURG IS EASY TO WORK...

Easy to Tool and Assemble Contractors Find Orangeburg Jobs Profitable

Like a willing horse, Orangeburg Conduit helps make jobs easier and more profitable for Contractors. That's because its light weight and long lengths make for easy handling and ready work-ability. Orangeburg always lays faster and at lower cost than any other type of conduit.

THE USER GETS A BETTER JOB... YEARS ADDED TO CABLE LIFE

. . . because Orangeburg's low coefficient of friction keeps pulling tensions on cable to minimum . . . because its smooth bore protects cables from abrasion . . . because it combines toughness and flexibility in ideal proportions to withstand traffic shocks, soil settlements or temperature changes . . . because its permeable wall and tight joints prevent infiltration of corrosive ground waters . . . because it resists acids, alkalis, grease, oil, salt.

The *orange-colored* trademark identifies *all* Orangeburg Conduit for your protection. SEND FOR FREE Illustrated Folder. Write to Dept. EC-6, Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

ORANGEBURG *Fibre* CONDUIT

STANDARD *installed with Concrete* · **NOCRETE** *installed without Concrete*

NOCRETE for one or two ducts . . . installed *without* concrete encasement.

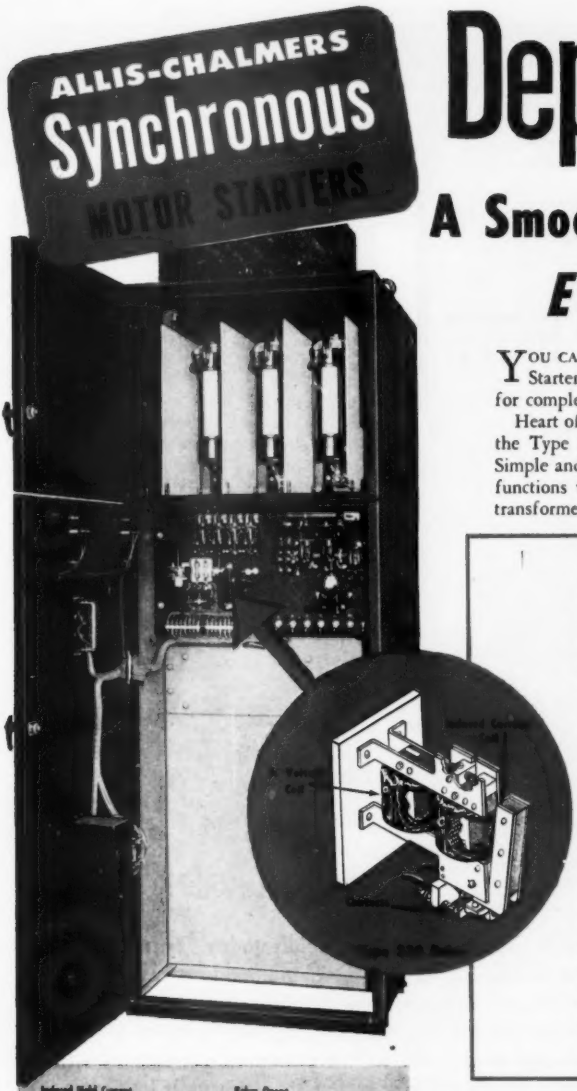
STANDARD for three or more ducts . . . installed *with* concrete encasement.

GraybaR ELECTRIC COMPANY

DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

GENERAL ELECTRIC SUPPLY CORPORATION

Branches and Stocks in Principal Cities



Dependable..

A Smooth, Accurate Start *EVERY TIME!*

YOU CAN DEPEND on Allis-Chalmers Synchronous Motor Starters for accurate and consistent field application . . . for complete line-to-load protection.

Heart of the Allis-Chalmers Synchronous Motor Starter is the Type 230 polarized field-frequency application relay. Simple and dependable, this single relay performs all these functions without the use of primary potential or current transformers:

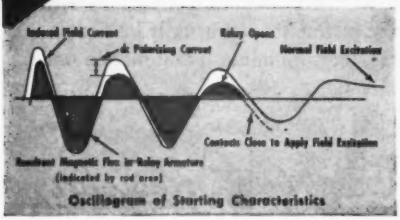
★ **Applies dc excitation automatically when proper rotor speed is reached.**

★ **Selects exact half cycle and the most favorable angle between rotating field and revolving magnetic stator field to apply excitation.**

★ **If motor pulls out of step, it removes field excitation promptly at instant of pull-out.**

★ **Resynchronizes automatically after pull-out if condition has been corrected.**

THIS IS HOW THE RELAY WORKS. The transformer action between the stator and the rotor of a synchronous motor (during acceleration) causes an alternating current to be induced in the field circuit of the rotor. A decrease in the magnitude and frequency of the induced rotor current as the motor accelerates, together with a biasing voltage from the excitation source, causes the Type 230 field application relay to apply field excitation at the most favorable point of stator-rotor relationship. The relay will maintain the field excitation during normal motor operation, but will operate to remove the excitation on motor pull-out. The relay will resynchronize the motor if the pull-out condition has been removed before protective devices operate to disconnect the motor from the line.



Oscillogram of Starting Characteristics

All Allis-Chalmers motor starters . . . those for synchronous, wound-rotor and squirrel-cage motors . . . give you everything you need for complete control and protection of your motors. The attractive, easy-to-install steel cubicles are compartmented to protect personnel — arranged for simplified maintenance. For more information, call your nearby A-C representative, or write Allis-Chalmers, Milwaukee 1, Wisconsin, for Bulletin 14B6410A.

A-3480

ALLIS-CHALMERS

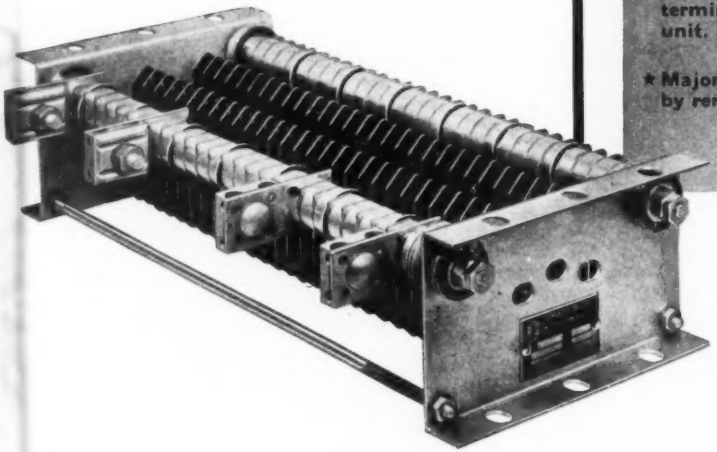
There is an Allis-Chalmers Starter for Every Motor Need

QUICK CHANGES *are Easy*

with P-G... STANDARD RESISTOR UNITS

Little Effort Required To Make Adjustments

- ★ Minor variations often possible by wire change to other available terminals.
- ★ Greater variations easily produced by movement of terminal position in the unit.
- ★ Major variations effected by removal or addition of one or more standard banks.



Write for
BULLETIN No. 500E

OPERATING conditions change rapidly today. To meet new production schedules it may be advisable to adjust resistor layouts to do a better and faster job. P-G Standard Resistor Units already in use, and a few spares in the supply room, help in making needed alterations within a minimum time and with utmost efficiency. Normal adjustments can usually be accomplished within a few minutes. For minimum maintenance and maximum production, use P-G . . . . . .

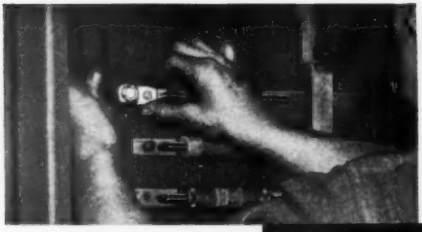
P-G

The Nonbreakable Steel Grid Resistor

THE POST-GLOVER ELECTRIC COMPANY

• ESTABLISHED 1892 •

221 WEST THIRD STREET, CINCINNATI 2, OHIO



① INSTALLED 1936

② SALVAGED

③ RE-INSTALLED 1951

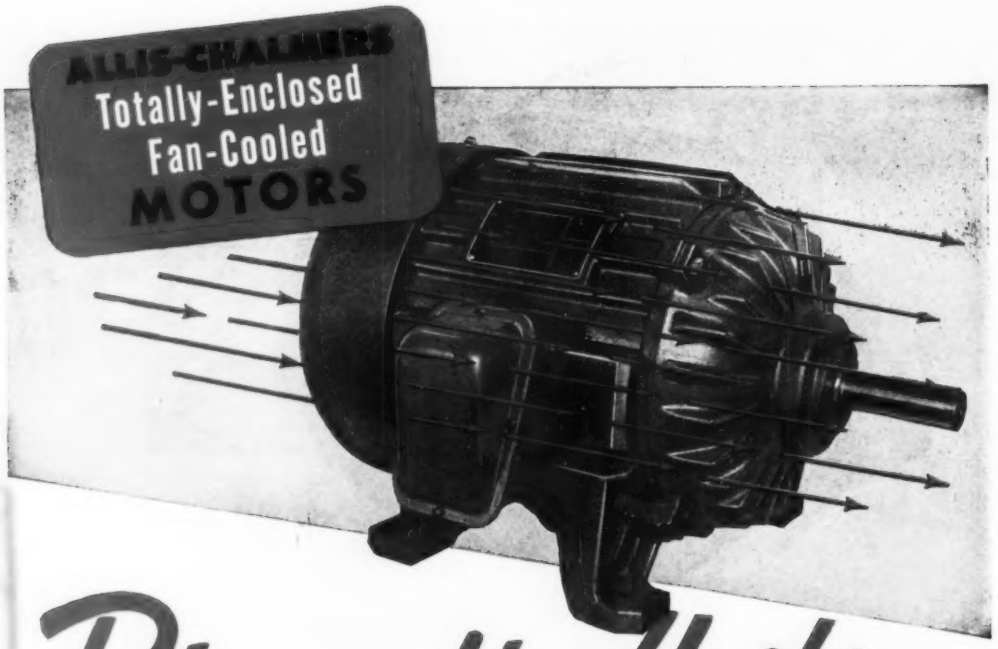
RE-USABLE after 15 years!

BURNDY QIKLUG

After 15 years, this Qiklug is ready for another long stretch of service. Quickly installed, quickly removed—a wrench does it. Clean, rugged threads resist stripping. That's why compact, efficient Qiklug connectors can be used over and over again. Today, especially, it pays you to take advantage of Qiklug's salvage value—to help you stretch stock and cut costs.

BURNDY CONNECTORS

BURNDY • NEW YORK 54, N. Y. • WESTERN BRANCH: VERNON 58, CALIFORNIA
BURNDY CANADA LTD., TORONTO 8, ONTARIO 281



Blows itself clean as a Whistle!

DIRT IS CARRIED AWAY by cooling air blown over the ribbed cast iron frame and bearing housings of this new Allis-Chalmers tefc motor. That means less motor cleaning . . . inspection . . . overhaul!

Concealed air passages and pockets have been eliminated. Dirt can't build up to cause overheating. And as for oily dirt that sticks — just wipe or blow it off.

Studies show that on most applications, totally-enclosed fan-cooled motors more than pay back their extra cost in reduced maintenance. And this new Allis-Chalmers Type APZ tefc motor makes maintenance costs lower than ever before.

Rigid Construction

The frame is cast iron which has high resistance against corrosion and distortion. Bearings are pre-lubricated at the factory and should need no attention for years. Tapped holes with pipe plugs to permit regreasing and to provide grease relief are standard equipment.

Get All The Facts

The new Allis-Chalmers Type APZ totally-enclosed fan-cooled motor is built in all NEMA standard frame sizes from 224* to 505. Also in explosion-proof type. Your A-C Authorized Distributor or District Office has complete information. Call today, or write Allis-Chalmers, Milwaukee 1, Wisconsin. Ask for Bulletin 51B7225.

A-3427

Sold . . .
Applied . . .
Serviced . . .

by Allis-Chalmers Authorized Dealers, Certified Service Shops and Sales Offices throughout the country.

CONTROL — Manual, magnetic and combination starters; push button stations and components for complete control systems.

TEXROPE — Belts in all sizes and sections, standard and *Vari-Pitch* sheaves, speed changers.

PUMPS — Integral motor and coupled types from ¾ in. to 72 in. discharge and up.

Texrope and Vari-Pitch are Allis-Chalmers trademarks.

ALLIS-CHALMERS

*Similar design non-ventilated motors Type APK, also available in frames 203 to 224 inclusive

Timely Facts and Features You'll Find in the NEOPRENE NOTEBOOK

- how you can reduce maintenance costs
- ways to solve many production problems
- new ideas on neoprene's wide range of uses
- technical help in specific applications
- details of new improvements in old products
- interesting new neoprene products

FACTS ABOUT NEOPRENE FOR THE ENGINEER
PRODUCTS MADE OF NEOPRENE RESIST ATTACK BY MANY CHEMICALS
Products made of neoprene have been successfully used in contact
FACTS ABOUT NEOPRENE FOR THE ENGINEER
LOW TEMPERATURE TESTING OF ELASTOMERS... PART 1
DU PONT

YOU'LL FIND PROFITABLE READING in every issue of the Neoprene Notebook. Informative, up-to-the-minute articles on neoprene's properties, performance, and new neoprene products help you step up production efficiency and cut expenses. The feature articles in the two issues shown here are good examples of the authoritative reports that appear regularly. Pictures, graphs and charts make for easy, thorough understanding. Each issue is packed from cover to cover with new ideas to save you time, and money. Put your name on our mailing list. Subscriptions are FREE.

CLIP THIS COUPON AND MAIL IT TODAY

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The rubber made by Du Pont since 1932

DU PONT

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

E. I. DU PONT DE NEMOURS & CO. (INC.)
Rubber Chemicals Division, T-10
Wilmington 98, Delaware

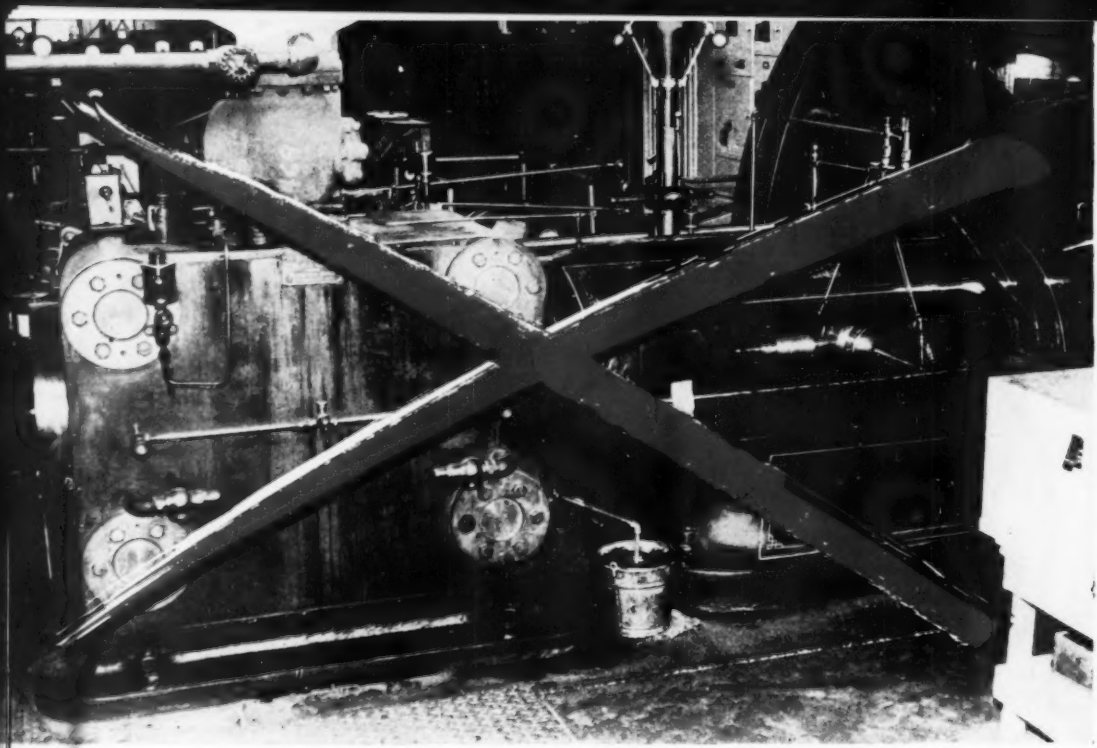
Please send me free issues of the Neoprene Notebook.

Name_____

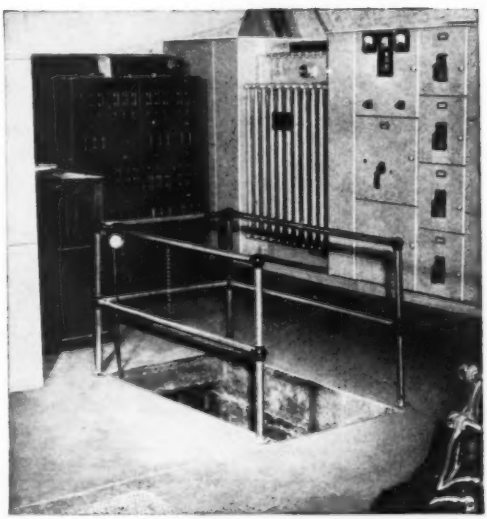
Position_____

Firm_____

Address_____



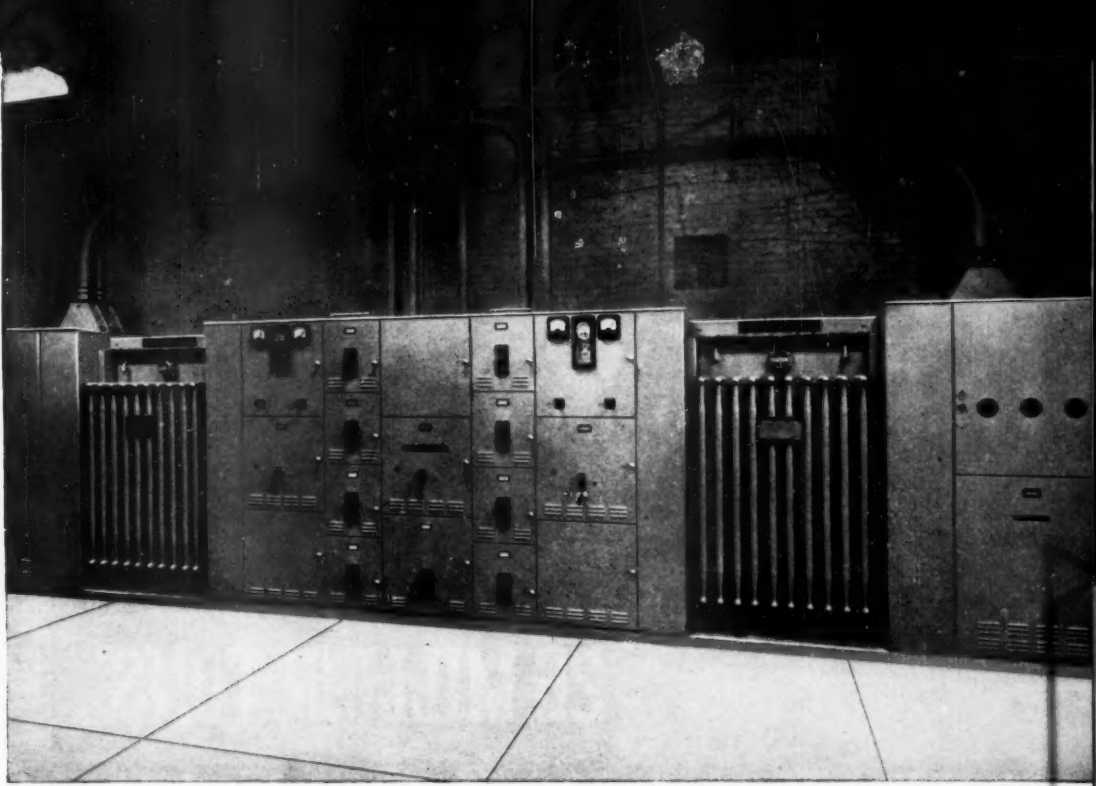
Obsolete power supply completely



G-E LOAD CENTER UNIT SUBSTATION was installed without interruption of the plant's power. Sectionalized design permitted the two-step operation in which the generator's load was thrown on one transformer before the steam engine and generator were removed.

THE STEAM-DRIVEN GENERATOR pictured above supplied much of the power used by the Illinois Cabinet Company. Rated at 500 kva, it was severely overloaded much of the time. Failures of steam, engine and generator resulted in costly shutdowns.

The company could have saved $9500 in power costs if it had been purchasing the power it generated in 1947 and 1948. In addition, it would have avoided the expense of handling 56 carloads of coal.



replaced without plant shutdown!

G-E load center system saves Illinois Cabinet Company $4500 annually—simplifies future expansion

Plagued by costly power failures and poor voltage conditions, the Illinois Cabinet Company, Rockford, Illinois, called in the General Electric Company for a complete remodeling of its power system.

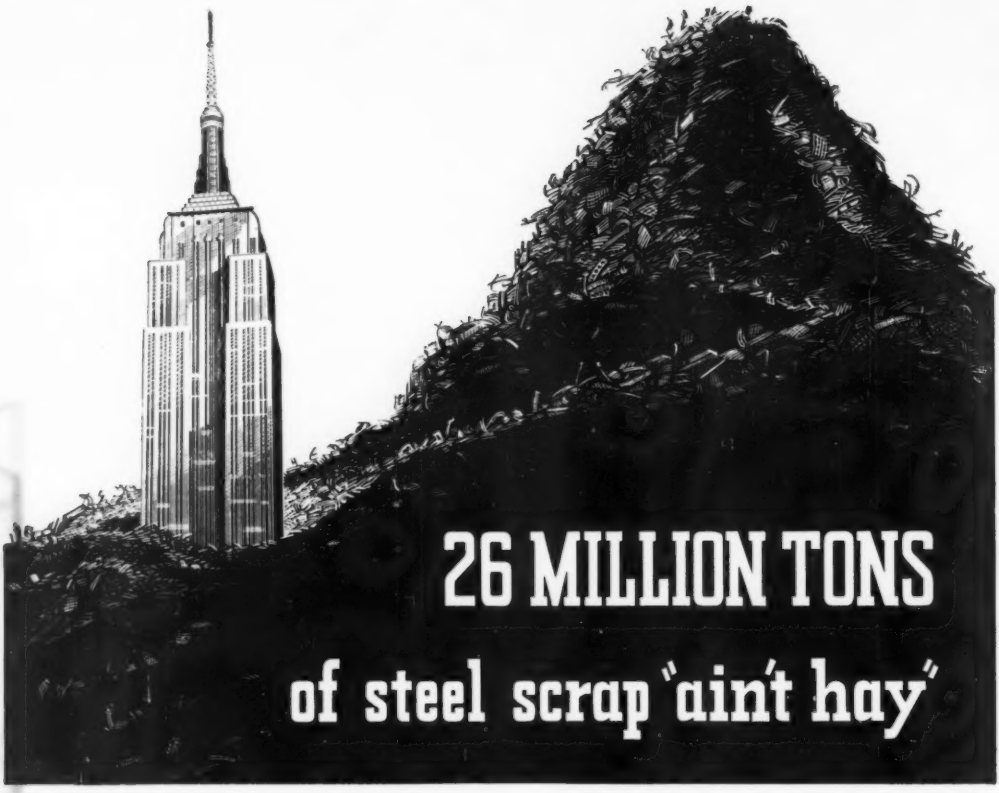
In place of the old 500-kva, 240-v steam-driven generator, G-E engineers suggested a 1000-kva load center unit substation and the purchase of *all power from the local utility.* In addition, they proposed a new feeder system to simplify the existing circuits, reducing voltage drop and copper losses. Calculations showed that power costs could be cut by $4500 annually.

To minimize lost production time, the double-ended load-center unit was installed in two sections since it could not be completely assembled until the old steam engine was removed. After the first section was installed, the generator's load was thrown on the new transformer. Then the steam engine and generator were removed and the second section was fitted into place. In two week-ends the transformation was complete.

You, too, can get a power distribution system adapted to today's constantly changing production picture. See your G-E sales representative, or write for Bulletin GEA-3592 Load Center Unit Substations and GEA-5600 "Electric Power for Industry's Third and Biggest Expansion." General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

321-79



26 MILLION TONS of steel scrap "ain't hay"

IT took 57,000 tons of steel to build the Empire State Building in New York. That's about one-tenth of one percent of the tonnage of scrap required to produce the new steel demanded for America's defense and civilian needs this year.

Half of this scrap is produced by the steel mills themselves. The other half - approximately 26 million tons - must be supplied by the public. That tremendous tonnage is the equivalent of 461 Empire State Buildings - over 1400 carloads of scrap every day of the year.

Right now there is a scrap shortage. It threatens to interfere with steel production. So we appeal to you, as a user of steel and steel products, to do all you can personally to help collect scrap.

Somewhere in your place of business - and even at home - there are things that can be scrapped - worn-out or obsolete machines, pipe, boilers, tools, structural parts, etc., that you'll never use again in their present form. Turn them in through regular channels. Call the nearest dealer and start your scrap on its way to the steel mills - to help America reach its production goal of 105 million tons of new steel in 1951. It is this team-work that will help us win the victory again.

YOUR SCRAP IS NEEDED — YOUNGSTOWN

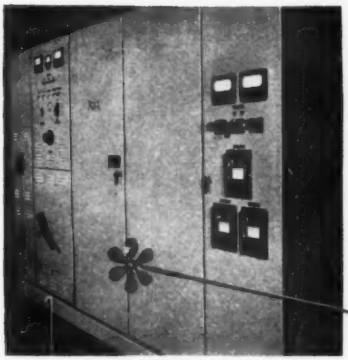
The Youngstown Sheet and Tube Company

General Offices--Youngstown 1, Ohio
Export Offices--500 Fifth Avenue, New York
MANUFACTURERS OF CARBON ALLOY AND YOLOY STEELS

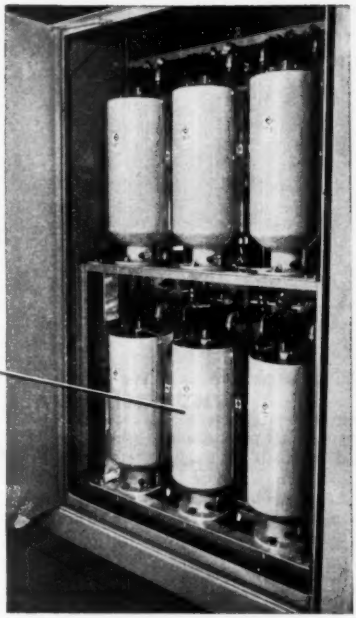
The steel industry is using all its resources to produce more steel, but it needs your help and needs it now. Turn in your scrap, through your regular sources, at the earliest possible moment.

Don't build around obsolete DC supply

—RETIRE IT NOW!



Modern Allis-Chalmers factory packaged, sealed tube, 500 kw mercury arc rectifier as installed in midwestern industrial plant. Left: "dead-front" compartments for dc feeders, dc metering and cathode breaker, rectifier tubes, and ac control and metering. Right: interior view of mercury arc rectifier tube compartment.



NOW IS THE TIME to retire obsolete converting and generating equipment. As operations expand, this inadequate equipment will become a growing handicap.

Now too — while there is a favorable base for amortization — is the time to consider mercury arc rectifiers for your expansion plans. Let Allis-Chalmers show you how the *modern* mercury arc rectifier can improve your direct current service.

LOW MANPOWER REQUIREMENT. With push-button starting and no synchronizing required, attendants are not needed during normal operation. Down-time for maintenance is reduced with no moving parts to lubricate or wear.

LOW COST OPERATION. Conversion efficiency is higher at all loads with large power savings during light load periods.

CONVENIENT INSTALLATION. Factory packaged, light in weight, and requiring no special foundation, Allis-Chalmers mercury arc rectifiers may be placed right at the load center.

IMPROVED PLANT OPERATION. With dc load center installation, distribution distances are cut, dc feeder losses are reduced, and full voltage is available at production equipment.

Whatever your specific direct current needs, Allis-Chalmers builds suitable and truly modern mercury arc rectifiers to meet them.

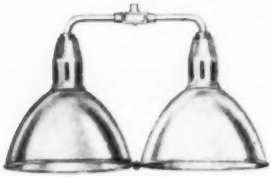
Sealed tube rectifiers (as shown above) are supplied in ratings from 200 to 1000 kw for lighter duty service. These are commonly used in large buildings, industrial plants and electric haulage systems. Pump evacuated rectifiers are built from 750 kw to the largest ratings required for heavy duty applications.

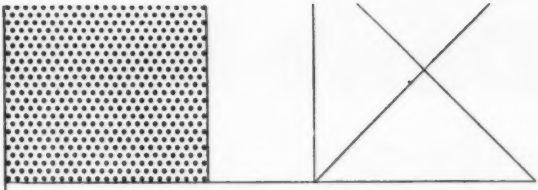
An Allis-Chalmers representative will be glad to explain in detail how these modern mercury arc rectifiers will improve the operation of *your* direct current system. Call your nearest A-C office or write to Allis-Chalmers, Milwaukee 1, Wisconsin.

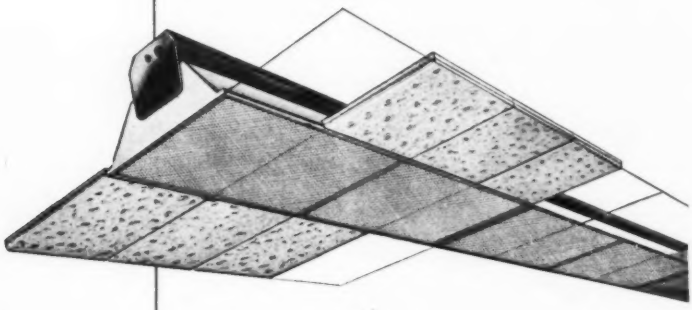
A-3467

ALLIS-CHALMERS A-C

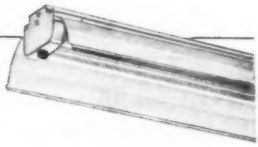
MERCURY ARC RECTIFIERS







WHY MILLER RATES YOUR CONSIDERATION WHEN YOU ARE PLANNING LIGHTING



Because of experience — 107 years' pioneering and progress in GOOD Lighting. *Because of all-inclusive equipment* for the best use of all light-sources — Fluorescent, Incandescent and Mercury-vapor. *Because of wide acceptance* — America is dotted with Miller lighting installations in stores, offices, schools, factories, and public buildings.

Miller Lighting Systems are built on an 8-Point QUALITY standard, designed to provide light of highest efficiency, and to give long satisfactory service. Engineering features make for easy installation and maintenance, and these make for LOW OVERALL COST (cost of equipment, installation and maintenance). You can light with confidence the proven Miller way. Miller field engineers and distributors are conveniently located for nation-wide service.

THE miller COMPANY MERIDEN, CONN.
SINCE 1844

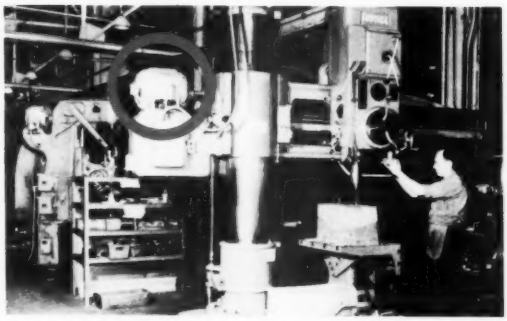
ILLUMINATING DIVISION: Fluorescent, Incandescent, Mercury Lighting Equipment
HEATING PRODUCTS DIVISION: Domestic Oil Burners and Liquid Fuel Devices
ROLLING MILL DIVISION: Phosphor Bronze and Brass in Sheets, Strips and Rolls

"We have three shifts in operation," says Julius J. Domonkos, Vice-President in Charge of Manufacturing, Bell Aircraft Corporation. "That's full production on a 24-hour day basis. For the past 10 years we've been depending on Tri-Clad motors to carry the load. We've never regretted putting our confidence in this fine motor!"

G-E Tri-Clad Motors drive the machines that are instrumental in producing helicopters, guided missiles, rocket motors, research aircraft, and jet aircraft engine nacelles for our rapidly expanding armed forces. At Bell Aircraft Corporation, G-E Tri-Clads are known as a thoroughly dependable motor —tough on the outside . . . on the inside . . . at the bearings.

BELL AIRCRAFT CORPORATION:

"We've been depending on Tri-Clad* Motors for Ten Years . . ."



This Tri-Clad driven radial drill takes care of most of the large dies for the entire Bell plant. Big dies and bolster plates are drilled and tapped on this machine, a critical part of the Bell operation. Despite continuous use, plant personnel can't remember a single interruption due to Tri-Clad failure!

*Reg. trademark of General Electric Co.

FASTEST BOMBER IN THE WORLD! Jet engine nacelles for the 600-plus miles-per-hour B-47 are being produced at a record-breaking clip in the Bell plant at Buffalo, N. Y. The "Stratojets" represent a major advance in bombardment aircraft.

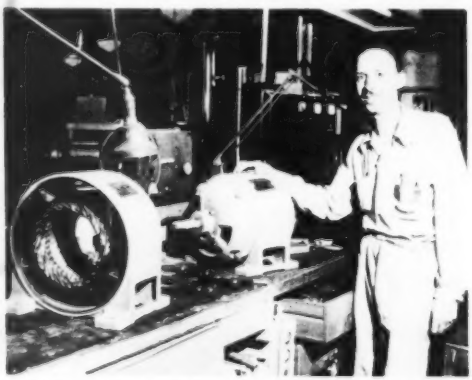
GENERAL ELECTRIC

TRI CLAD MOTORS

REG. U.S. PAT. OFF.

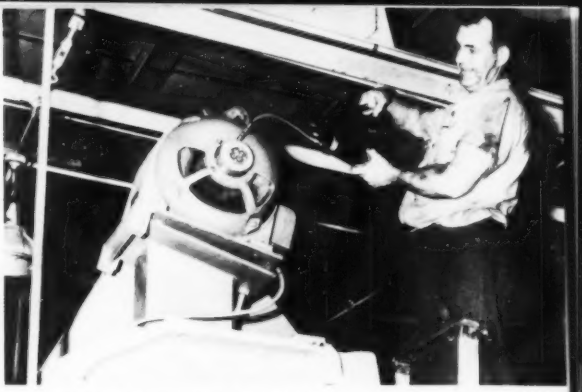
Help keep Bell Aircraft production up!

Marvin Limburg (left), Foreman of Bell's Tool and Die Shop, comments, "I don't believe we've ever lost machine time due to breakdown of Tri-Clad motors. And our jig-borers, for example *have been operating around the clock for the last 8 to 10 years!*"

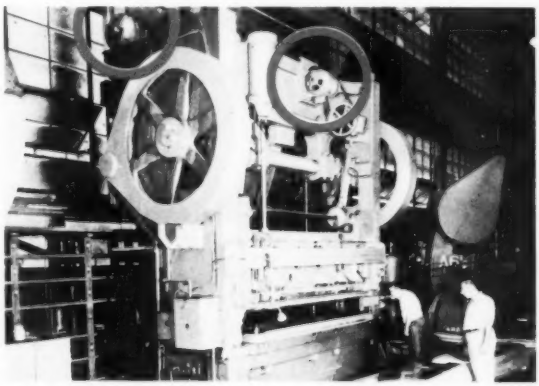


"It's the easiest motor we have to maintain" according to Maxwell Anderson, Crew Chief of Bell's motor repairmen. "There's more working room inside and more room in the slots. It's become a byword with us that if you give a Tri-Clad motor ordinary care you'll never have to worry about maintenance."

TIMELY READING—With every electric motor needed on the line, you'll want a copy of the G-E manual on "How to Maintain Motors and Generators." It's free; just ask for bulletin GET-1202. *Sect. 752-10, General Electric Company, Schenectady 5, N. Y.*



Greasing isn't necessary on a Tri-Clad motor in normal service, but it's always reassuring to know that you *can* lubricate if you so desire, without time-consuming disassembly. The photo shows how easy it is: remove relief plug, attach the grease gun nozzle, squirt—the job is finished.



This huge punch press is an important tool maker. Anton Geiser (right), assistant punch press foreman, says: "I can't recall a single shutdown of this section due to motor failure." Almost all motors in this department are Tri-Clad. This is another Bell Department which has been operating around the clock; cannot afford to lose time because of motor breakdown.

NEW! A Helpful Training Course on Motors!

Everyone concerned with technical training problems will want this new G-E Motor Selection and Application Course. Consists of 9 short, easily understood lessons. Complete kit —slide films, review booklets and instructor's manual— $100.00. Call or write your nearest G-E sales office.

Look at the Scope of this Course

1. Fundamentals of Motors
2. Types of Motors
3. Fundamentals of Selection
4. A-C Induction Motors
5. Single-phase Motors
6. D-C Motors
7. Synchronous Motors
8. Adjustable-speed Drives
9. Gear Motors

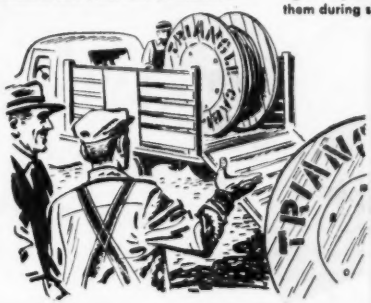
GENERAL ELECTRIC

I told the boss it was Clean as a Whistle!

It was a big atomic energy job and we wanted everything to be just right. "Is this stuff clean?" asks the boss, eyeing a rack of conduit. I told him it was Triangle and *it had* to be right but he wanted to see for himself. "Good—no burns, no rough spots and it's hot-dipped galvanized. That's the kind of conduit I like to see."

I figured while I had him in a good mood, I'd give him the rest of the story. "See how easy it bends, nice and even all around and there's no flaking on the bends. You never get any broken threads either because Triangle makes conduit and couplings the right way and the threads are capped to protect them during shipment."

I took him over to where we were doing some branch circuit work. "Pulling wire is a cinch with Triangle's Glazon. That slick braid sure helps to do the trick. Glazon seems to be extra tough, too. Stands up better than anything we've ever used."



The boss asked me what kind of service I was getting and I told him, "Triangle and their distributors have never let me down. I don't have to go chasing after their salesmen. They check up on deliveries to see that we get the material on the job when we need it and are always glad to help me in any way they can."

The boss doesn't say much but he walks off with a smile on his face. Whether you're the boss or the guy on the job, take a tip from me—

ASK YOUR ELECTRICAL DISTRIBUTOR— HE KNOWS—

It MUST Be Right

THE TRADE-MARK OF TOP QUALITY!

TRIANGLE CONDUIT & CABLE CO., INC.

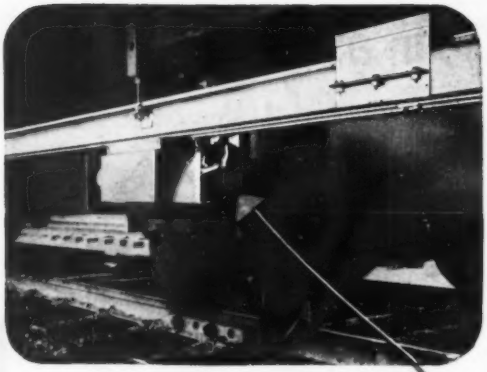
NEW BRUNSWICK, NEW JERSEY

IT *MUST* BE RIGHT

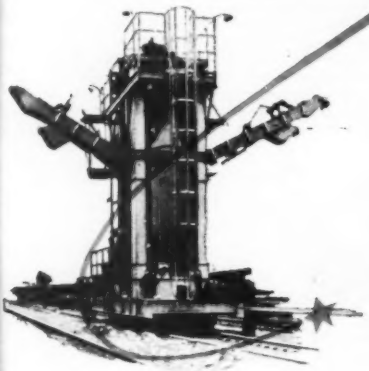
"Glazon" Building Wire • "Glazon" Non-Metallic Sheathed Cable • Armored Cable • Service Entrance, Service Drop, Varnished Cambric Braided or Leaded, Trioprene Trench, Power and Parkway Cables • Bare Wire • Rigid Conduit Hot-Dipped Galvanized • Electric Metallic Thin Wall Conduit • Flexible Steel Conduit

From

FREIGHT CAR ICING

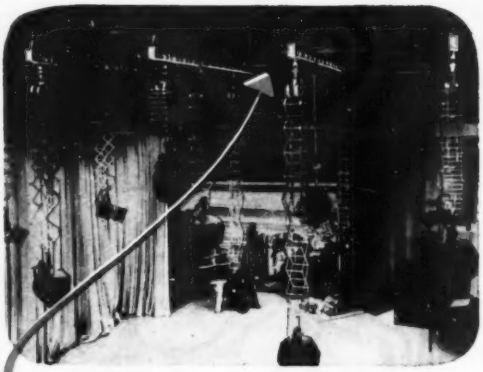


Above, track and trolley supplying current to one of two icing machines, shown below, developed by Railways Ice Co., and built by Link Belt Co., for Denver & Rio Grande Western R.R.



To

TELECASTING



Feedrail powers and positions vertically heavy TV lights by a flick of a switch.

ELECTRIC FEEDRAIL®

Mobile Power Outlets Move Jobs on Schedule

A freight car iced in fifty seconds! Only a ten second interval between cars! That's how trainloads of perishable freight are now iced and speeded to market on schedule. When this modern icer is on the move, power is supplied by Feedrail for twelve motors totaling 179 HP plus 7½ KW for communications, lighting and coded control. In telecasting, split-second timing to keep on schedule is essential. Feedrail mobility speeds the rearranging of studio lighting and provides a dependable, unfaltering source of power.

Industry is always on the move. Product changes demand flexible electrical power distribution. Moving Feedrail trolley outlets enclosed in overhead tracks roll quickly to where power is needed. When major changes are required — dismantle, rearrange and remount, reusing original units. Add or remove machines, without delay, to speed change-overs and work in process. Unit costs will decrease in direct ratio to the increased production facilities which Feedrail versatility affords. Write for literature.

Sold by leading electrical distributors.

46-B

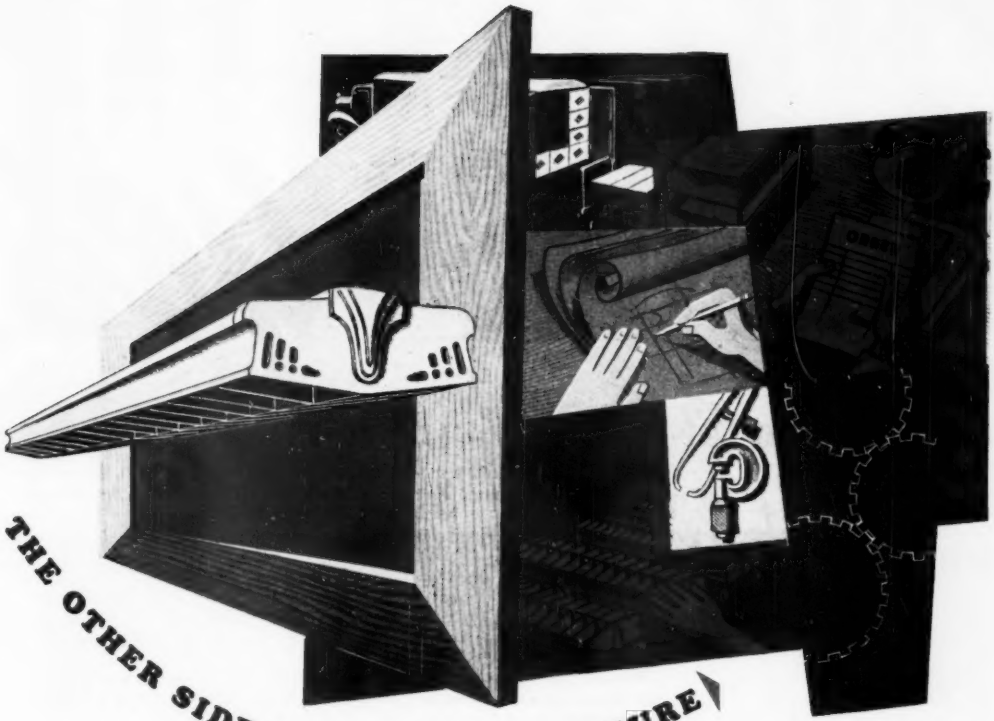
ELECTRIC FEEDRAIL®

Never Becomes Obsolete

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET · NEW YORK 7, N. Y.



THE OTHER SIDE OF THE GUTH PICTURE

we are big—
—and we are small

we are big enough to massproduce
any huge installation project—
—and small enough to tailormake that one fixture in
the corner store or the board chairman's glamour office

we are big enough for assembly-line work—
—and small enough to work with you on
any special lighting problem

we are big enough to produce a complete line
of commercial and industrial fixtures—
—and small enough to keep our executives' doors open for
you any time you need help

we are big enough—
—and small enough
to be your friends

Ed P. Guth

Guth LIGHTING

THE EDWIN F. GUTH COMPANY / ST. LOUIS 3, MISSOURI

Leaders in Lighting since 1902

MILLIONS? *yes*

HOW LONG HAVE STAB-LOKS BEEN ON THE MARKET?

Federal Noark introduced Stab-lok Circuit Breakers in mid-year, 1950. Sales were phenomenal right from the start and soon ran into millions. Today the demand is greater than ever.

WHAT ABOUT STAB-LOK DEPENDABILITY?

With millions in service, Stab-lok dependability speaks for itself. Stab-loks are built up to a standard, not down to a price. All parts are *over-size*, and manufacturing economies have been achieved solely by specially designed equipment and mass production techniques.

Stab-loks pass the same rigid Underwriters' Laboratories tests that are applied to the highest priced breakers of the same AC ratings. And Stab-lok is the lowest priced breaker whose performance is absolutely proven.

HOW AVAILABLE ARE STAB-LOKS?

With mass production in full swing, Stab-loks literally pour from the assembly lines. You can usually expect better delivery of Stab-loks than of any other breaker.

WHERE ARE STAB-LOKS SOLD?

Stab-loks are sold exclusively by progressive wholesalers the country over. Outmoding all popular fusible equipment up to 60 amps, Stab-loks won nation-wide distribution as soon as expanded production facilities enabled Federal Noark to meet the demand.

WHAT ARE STAB-LOK'S OUTSTANDING ADVANTAGES FOR CONTRACTORS?

Stab-lok enables contractors to give customers the safest, most convenient and modern circuit protection at fuse box prices! It is outstandingly easy to install. Enclosures have ample wiring space, and most of them are of the Noark combination type for flush or surface mounting. In addition, Stab-lok's low cost and the flexibility with which it meets almost any requirement makes it ideal as a stock item for contractors' shops and trucks.

AND NOW, BREAKERS FOR GREATER LOADS!

Now three new lines of Noark circuit breakers are in production . . . Type NE in 1, 2 and 3 pole construction with 250 volt AC and 50 amp. DC ratings . . . Type NF for up to 100 amps. at 600 volts . . . Type NK up to 225 amps. at 600 volts.

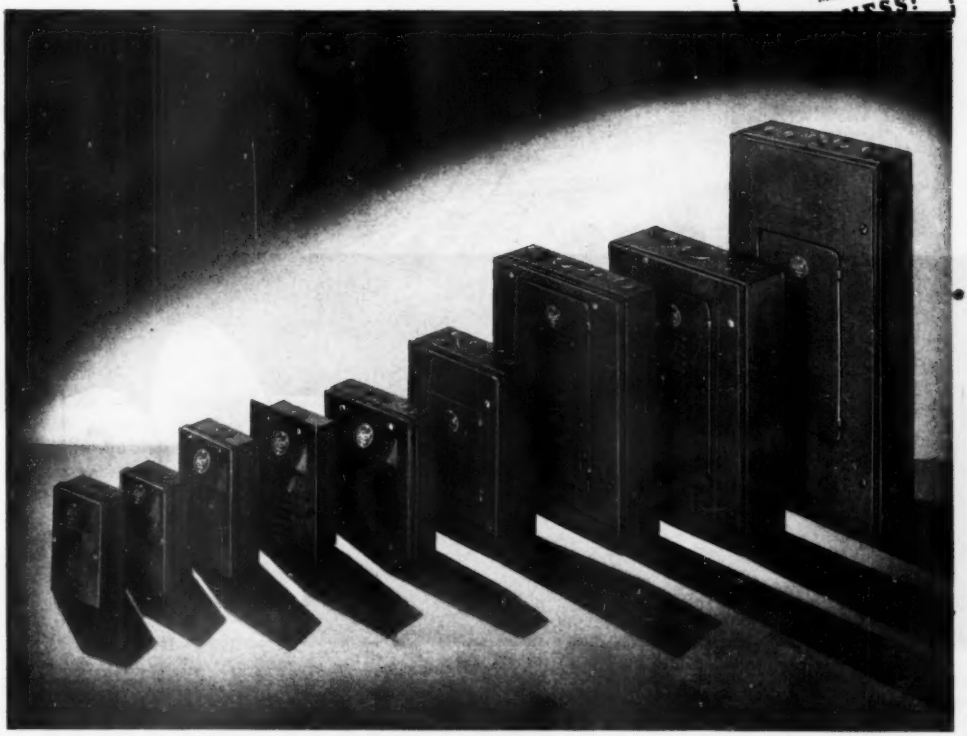
Get the full Stab-lok story—and order Stab-loks—from your wholesaler today. Federal Electric Products Company, 50 Paris St., Newark 5, New Jersey.

MILLIONS

OF *Stab-loks*

REGISTRATION APPLIED FOR

FEDERAL NOARK MEANS ...SSS!



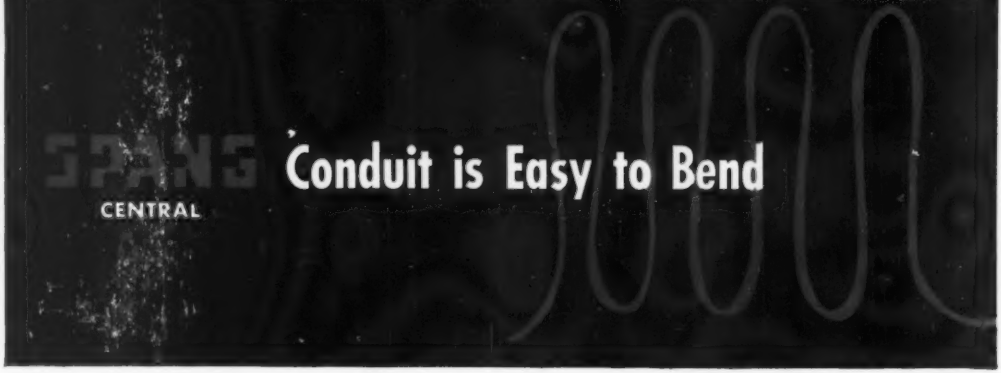
FEDERAL NOARK

Federal NOARK

Complete line of Federal Electric Products includes Motor Controls, Safety Switches, Service Equipment, Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

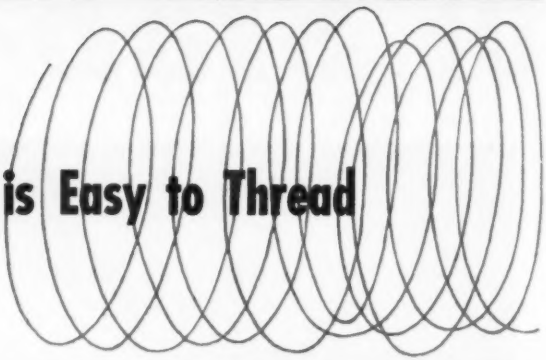
SPANG CENTRAL

Conduit is Easy to Bend



SPANG CENTRAL

Conduit is Easy to Thread



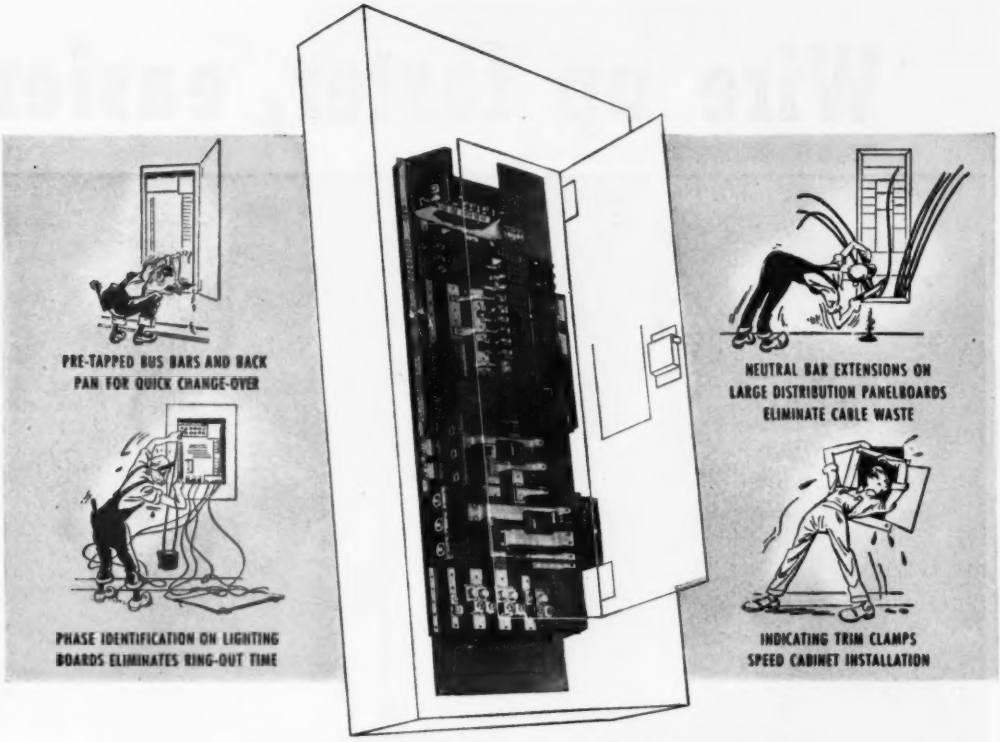
SPANG CENTRAL

Conduit is Easy to Cut

Choose the conduit best suited to your job from the Spang-Central Big 4 Conduit family . . . "Cenlaco", hot dipped inside and out . . . "Central White", black enameled inside, electro-galvanized outside . . . "Central Black," black-enameled inside and out, and "Central EMT," lightweight, clear enamel inside, electro-galvanized outside.

The Spang-Central Big 4 are approved by Underwriters' Laboratories and comply with the National Electric Code. Spang-Central rigid or lightweight conduit is sold through prominent, recognized distributors.

SPANG-CHALFANT
Division of The National Supply Company
GENERAL SALES OFFICE:
GRANT BUILDING, PITTSBURGH 30, PA.
District Offices and Sales Representatives in Principal Cities


PRE-TAPPED BUS BARS AND BACK PAN FOR QUICK CHANGE-OVER
PHASE IDENTIFICATION ON LIGHTING BOARDS ELIMINATES RING-OUT TIME
NEUTRAL BAR EXTENSIONS ON LARGE DISTRIBUTION PANELBOARDS ELIMINATE CABLE WASTE
INDICATING TRIM CLAMPS SPEED CABINET INSTALLATION

Take an *EXTRA LOOK!*

for cost-saving extras provided by Westinghouse Panelboards

Fast installations cut panelboard costs. Fast conversions for changing or expanding power requirements cut costs. Recently a prominent trade publication stated that design—type and accessibility of connections, gutter and wiring space and other features—can influence panelboard installation time by as much as 25%.

Here are time-saving, cost-saving extras Westinghouse Panelboards give you:

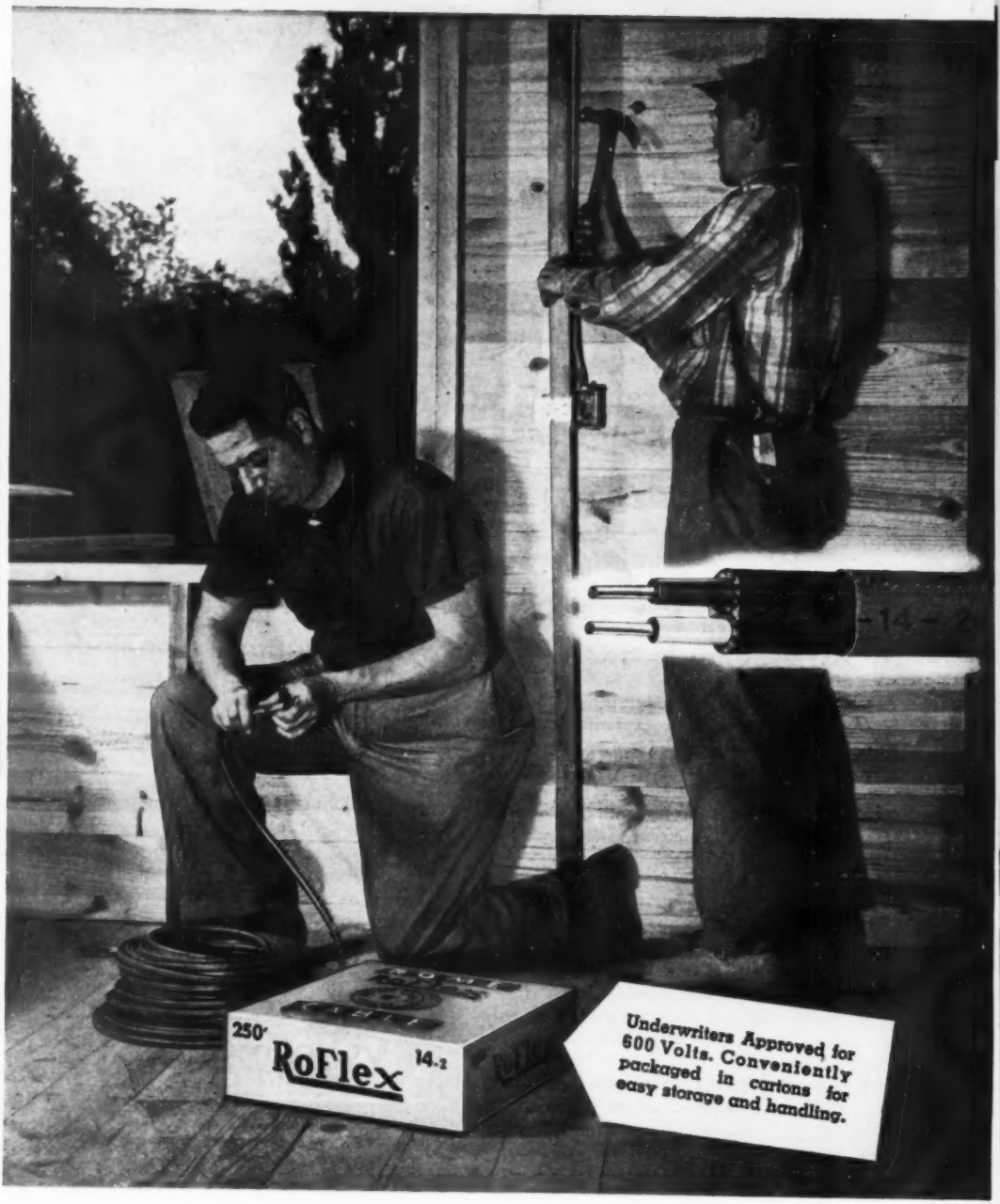
1. Built-in Neutral Bar Extension on convertible distribution panelboards—eliminates dragging main feeders entire length of panelboard to reach neutral bar; now—locate all feeder terminal connections at same end of panel.
2. Pre-Tapped Bus Bars, back pan and other parts provide screw driver convertibility when needed.
3. Indicating Trim Clamps make it easy to get the trim on or off—eliminate guesswork.
4. Permanent Pre-phased Identification—letters at each breaker and main bus identify sequence of breaker and bus connections on 3-phase, 4-wire lighting panelboards.

Quick-fasten access plates, trim angle support, reinforced back pan, interchangeable parts are other advantages—extras at no extra cost—provided in Westinghouse Panelboards.

Contact your Westinghouse office or distributor. Or write for Descriptive Bulletin No. 30-930—Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-93466

YOU CAN BE SURE... IF IT'S
Westinghouse
PANELBOARDS

Wire up faster, easier



with Rome RoFlex

New Gray Finish is Easy to Pull, Clean to Handle

Here is the "flex" electricians like to work with because it's easy to strip, easy to pull . . . clean to handle. With a new smooth, gray finish, RoFlex is a cinch to pull through joists and outlet boxes. Its finish is non-flaking, stays smooth . . . does not become tacky. You can bank on RoFlex to "wire up" faster and easier.

There is the pleasure, too, of a wiring job well done. The RoFlex gray finish means clean outlets, unmarred walls and most important, customer satisfaction.

Further, as are all Rome Cable products, RoFlex is manufactured to the highest standard of quality. Conductor insulation is a Rome Synthinol thermoplastic compound, resistant to flame and moisture and easy to strip. Over the insulation are "separators" of strong pre-treated wrapped kraft paper with valley fillers. When specified, the ground wire is solid copper covered with a paper wrap. Finally, under the flame and moisture resistant gray finish is an outer braid of combined glass and presaturated yarn for high resistance to mold and rot.

So, the next time specify Rome "RoFlex." No other name means as much in quality, convenience and profit for you.

Copper wire mill products are a Controlled Material under N.P.A. Controlled Materials Plan. USE YOUR CMP ALLOTMENT

600 V—ROME CABLE—ROFLEX NONMETALLIC

Rome RoFlex *2 and 3 conductor, with or without solid copper ground wire.*

OTHER ROME CABLE PRODUCTS

Packaged Weatherproof Wire—500 ft. cartons, sizes 14 to 6 AWG—the handy answer to many outdoor jobs.

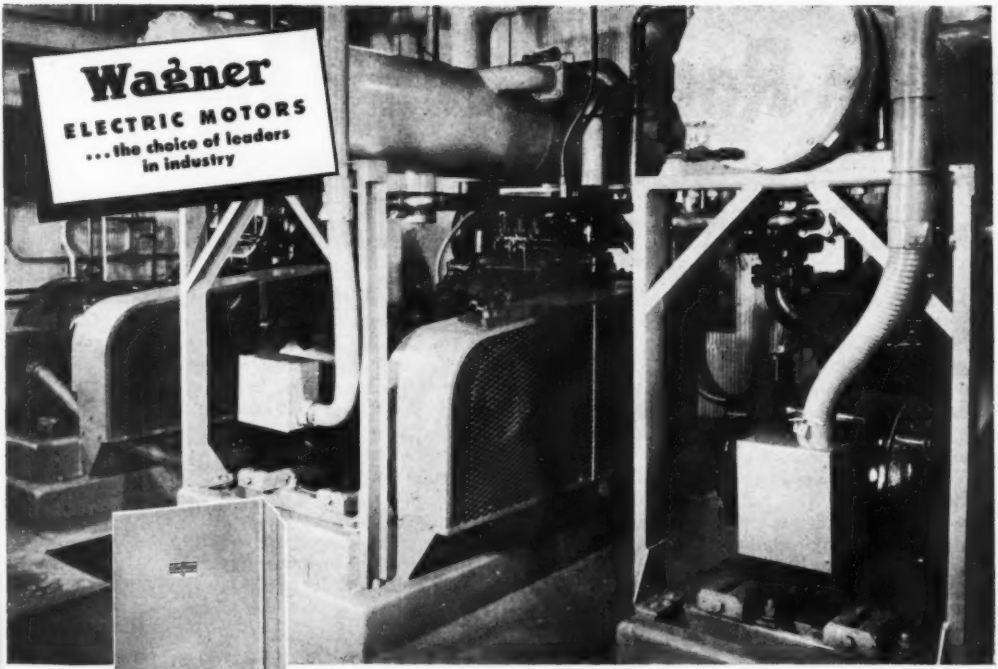
RoBarn—The original Neoprene nonmetallic sheathed cable for safe farm wiring.

RoMarine-RoPrene, Type USE—An economical all-resistant power cable for direct earth burial.

Rome "Dual-Purpose" Type RW-RH Building Wire—Saves inventory, approved for wet or hot locations.

It Costs Less to Buy the Best

ROME CABLE
Corporation
ROME · NEW YORK
and
TORRANCE · CALIFORNIA



Reduce starting current draw

the economical way with the Wagner Increment Motor and Starter Combination

On any application where reduced current draw at start is required because of locked current restrictions, you can limit the in-rush of motor current during the starting period with the low cost Wagner Increment Motor and Starter "Package."

A typical installation is shown in the photograph above, where three Wagner open-type general purpose motors rated 60, 100, and 125 hp are driving Worthington air conditioning units in a Minneapolis office building.

The Wagner Motor-Control Package is economical to install and permits the use of high grade magnetically operated control equipment at a low purchase price. For special requirements, the motor-control combination can be furnished with Wagner normal or high torque explosion-proof motors, splash-proof motors, or totally-enclosed fan-cooled motors as well as with the open type motor.

Why not investigate this Wagner combination today? Write for full information, or consult the nearest of Wagner's 31 branch offices, located in all principal cities.

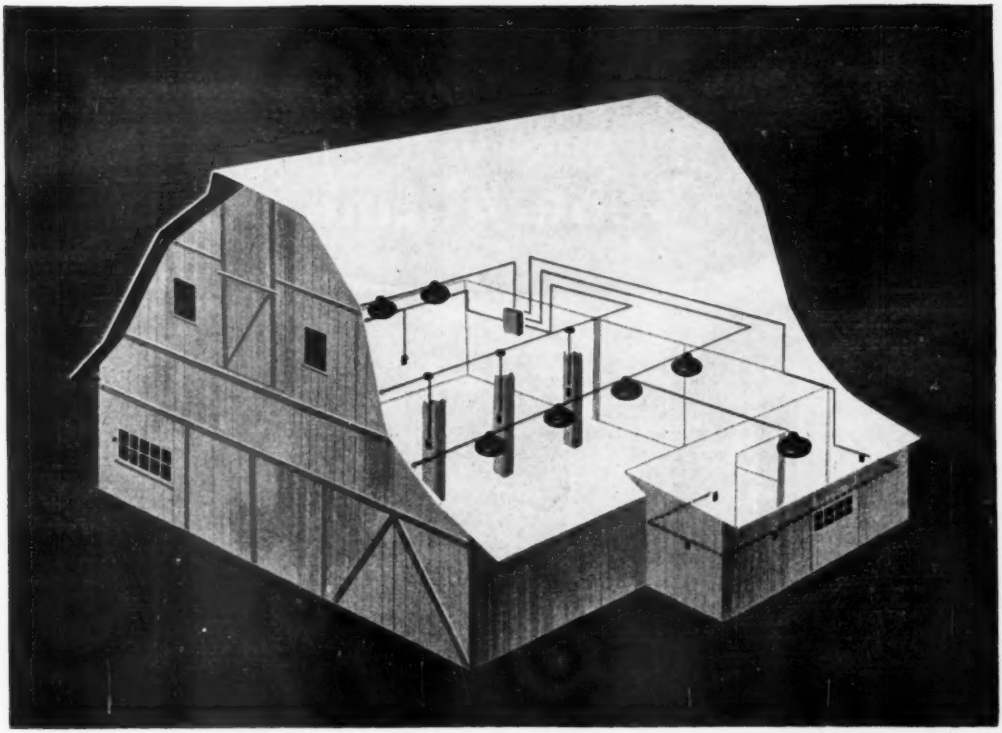
® Wagner Electric Corporation
1891 1951

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

ELECTRIC MOTORS · TRANSFORMERS · INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 31 PRINCIPAL CITIES

M51-17



PLAN FOR PERMANENCE...

when you install rubber-covered barn cable

Next time you contract for a farm wiring job, you'll build customer good will if you install long-lasting rubber-covered barn cable made with Fiberglas* Yarns.

Fiberglas Yarns:

- ***will not rot!***
- **will not absorb moisture!**
- **resist chemicals and acids!**
- **have great tensile strength!**
- **help make barn cable *last far longer!***

OWENS-CORNING
FIBERGLAS
Yarns

*Fiberglas is the trade-mark (Reg. U.S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibrous glass.

Because of increasing military requirements for Fiberglas Yarns, our customers are unable to get all they need. We are building new facilities to help meet these demands.

FIBERGLAS IS IN YOUR LIFE...FOR GOOD!

Owens-Corning Fiberglas Corporation
Electrical Sales Division, Dept. 636
[illegible] New York 17, N. Y.

Please send me a copy of the new booklet describing wires and cables made with Fiberglas Yarns.

NAME_____

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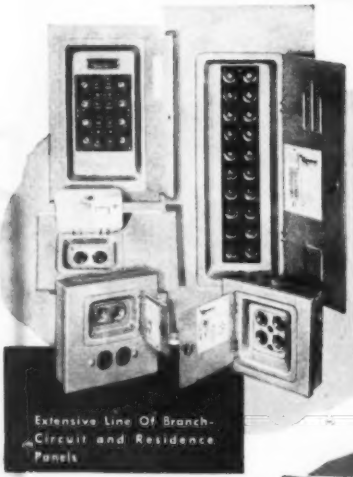
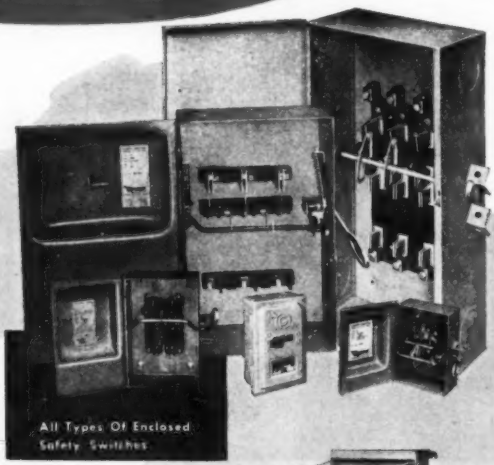
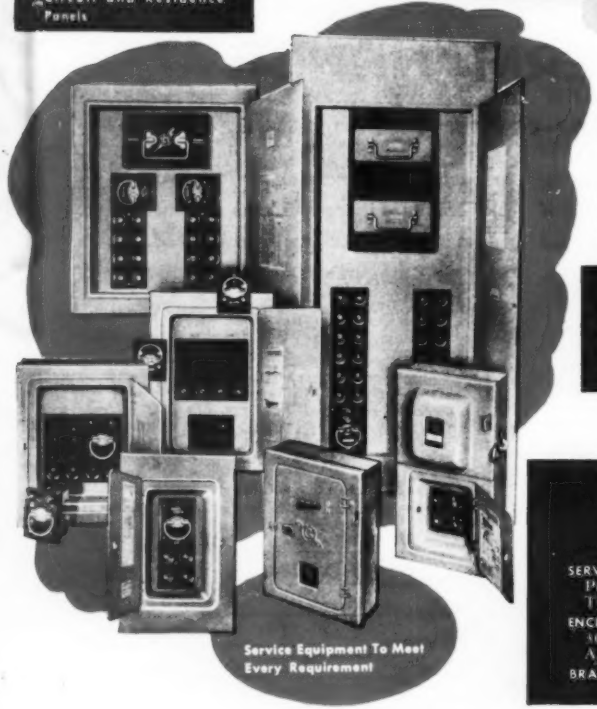
You'll Find Everything you need in the General Line



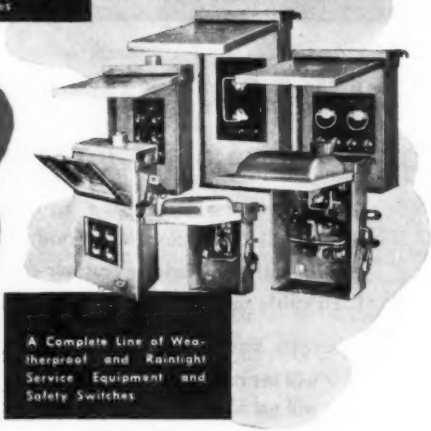
Extensive Line Of Branch-Circuit and Residence Panels



All Types Of Enclosed Safety Switches



Service Equipment To Meet Every Requirement



A Complete Line of Weatherproof and Raintight Service Equipment and Safety Switches

General Switch Corp.

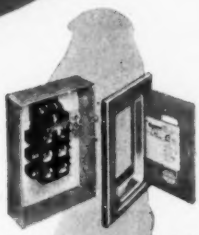
One of the Leading Manufacturers of:

SERVICE ENTRANCE EQUIPMENT . . .
Pullout, Front-Operated Toggle and Side-Operated Types. Indoor—surface or flush, and Outdoor.

ENCLOSED SAFETY SWITCHES
30 through 1200 amps., 250V through 600V, Types A, C and D. Indoor and Outdoor. HP rated.

BRANCH-CIRCUIT PANELS

. . . including A COMPLETE line of SERVICE ENTRANCE EQUIPMENT



Snap-action toggle switch. Sealable spring latch. Time and labor saving single fastening screw on surface trim. Flush or surface mounting.

Check off the ones you know

Front Operated Toggle Main Switch
Fusible Main Switch . . . . . ☐

30 Amps, 2 or 3 wires, 125 or 125-250 Volts, with up to 8 plug fuse branch circuits.

Non-Fusible Main Switch . . . . . ☐

30 and 60 Amps, 2 or 3 wires, 125 or 125-250 Volts. With up to 6 plug fuse branch circuits *or* up to 4 plug fuse branches and one branch pullout switch (30 or 60 Amps).

Can be furnished with duplex receptacle in trim or with bell transformer space and mounting bracket.

Available in Weatherproof and Raintight Enclosures for Outdoor Service . . ☐

Sealable dead front. Sealable spring latch on cover. Rust resistant steel enclosures.

Side Operated Main Switch . . . . . ☐

30* and 60 Amps, 3 wire fusible main switch, 125-250 Volts, with up to 8 plug fuse branch circuits.

***Available in Weatherproof and Raintight Enclosures for Outdoor Service** . . ☐

Quick-break open knife-blade side operated switch. Sealable dead front. Accessible branches.

Cover or Door Operated Main Switch . . . . . ☐

30 Amps, 2 or 3 wires fusible main switch, 125 or 125-250 Volts, with up to 8 plug fuse branch circuits.

Sealable door operated switch. Hinged outer door. Accessible branch fuses.

***Also* PULLOUT OPERATED SERVICE EQUIPMENT**—a complete line of 30, 60, 100 and 200 Amp pullout switches, available singly or in combination with plug fuse and/or pullout branch circuits; also main and range in series or multiple, triple pullouts, quadruple pullouts, etc. Flush or surface mounting and outdoor construction available.

NEW CATALOG—*Write for your free copy today.*

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Please send me new Catalog No. 5109 and latest price list.

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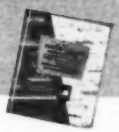
Sales Offices in Every Major City

The SURE WAY to Get The Lighting You Want . . .

Use the FLEUR·O·LIER INDEX SYSTEM to specify and select equipment



Now, you can take all guesswork and disappointment out of your lighting installations. You can get the exact lighting results expected by you, your architect or lighting advisor. You can be *sure* you'll be satisfied!

Merely ask the specification writer to express the illuminating characteristics you want—in the simple formulas of the Fleur-O-Lier Index System.

Then the problem of selecting the lighting equipment that will deliver precisely what is specified is easy. For every Fleur-O-Lier fixture is rated on its performance. You get *complete* information—the illuminating characteristics, coefficients of utilization, photometric test data and certification on its electrical and mechanical construction. You know in advance just what you're getting.

Don't gamble on a thing so important to increased sales as lighting—be sure you get what you want—specify and select with the Fleur-O-Lier Index System.

Free Booklet

Write for new booklet giving complete details of the Fleur-O-Lier Index System.

Also ask for Electrical Testing Laboratories' report of ratings assigned to more than 300 Fleur-O-Lier fixtures offered by 25 leading manufacturers.

address

Fleur-O-Lier Manufacturers
2116 Keith Building
Cleveland 15, Ohio

Certified
CERTIFIED
in accordance with Test Requirements of Specifications of Fleur-O-Lier Manufacturers
ELECTRICAL TESTING LABORATORIES, INC.
NEW YORK, N. Y.

FLEUR·O·LIER

Manufacturers

2116 Keith Building • Cleveland 15, Ohio

Fleur-O-Lier is not the name of an individual manufacturer, but of a group of fixtures made by leading manufacturers. Participation in the Fleur-O-Lier program is open to any manufacturer who complies with Fleur-O-Lier requirements.

R&S DUST-TIGHT LIGHTING FIXTURES

...for hazardous locations where flammable or explosive dusts are present. Class II, Groups E, F, G and Class III.

With 2 Exclusive Design Features

Now R&S engineering contributes a new and important stride forward in Type DL lighting fixture construction and installation simplicity!

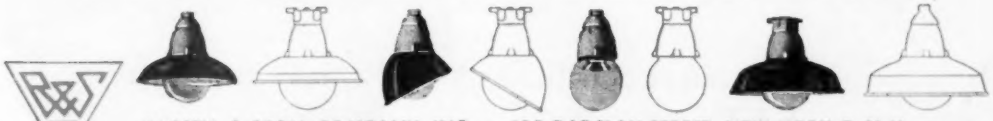
R&S Type DL Lighting Fixtures operate very *cool*—'way below allowable temperatures for this class of installation. They provide safe and efficient illumination for all locations where flammable or explosive dusts constitute a hazard.

Two R&S *exclusive* design features, added to the basic advantages common to other well-constructed dust-tight fixtures, are an important advance that assures faster, easier installation, and cleaning and relamping. Fixtures are made of rugged cast aluminum alloy—designed with smart streamlined simplicity—and shaped to prevent dangerous accumulation of dust particles. For detailed information and prices write for Data Sheet No. 7151-4.

1 Lampholders are located within the conduit box assembly of both pendent and junction box types, permitting installation and wiring without regard to size or style of fixture.

2 All fixture—globe—Reflector assemblies fit either base and are easily attached or interchanged by means of a simple bayonet slot and screw arrangement, without disturbing electrical connections.

Pendent and Junction Box bases are standard to all fixtures. They will accommodate any style fixture—globe—reflector assembly in either 100 watt or 200 watt sizes, providing complete interchangeability.



RUSSELL & STOLL COMPANY, INC. • 125 BARCLAY STREET, NEW YORK 7, N.Y. D-7

RUSSELL & STOLL

PRECISION-BUILT ELECTRICAL EQUIPMENT—SINCE 1902

"maintenance time cut 50%"

with Westinghouse MERCURY lighting

A typical customer's problem: "To reduce the time spent on lighting maintenance."

Westinghouse recommendation: "To install Westinghouse Mercury Lighting."

Result: "Less than half as many fixtures to maintain and fewer lamps to replace, because mercury vapor produces more light per luminaire than any other lighting system."

This is only one case out of hundreds of "time-tested" installations. All show evidence that Westinghouse Mercury Lighting is a fast growing industry favorite. Investigate the complete line: 400, 1,000 and 3,000-watt units for either low or high-bay areas . . . open or closed fixtures for clean or dirty locations . . . high or low-voltage ballasts for any distribution system. Send for B-4727, **"Westinghouse Lighting at Work" in every industrial area.** Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

YOU CAN BE **SURE**.. IF IT'S

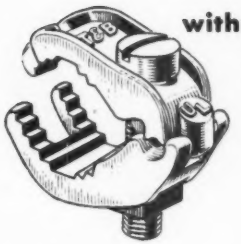
Westinghouse

LIGHTING DIVISION

Edgewater Park, Cleveland

J-04294

HANDLE LOTS MORE grounding jobs in lots less time



with multi-purpose, easy-to-use T & B Ground Clamps*

Take along just *two* types of T & B Clamps—and you can take *on* 'most any grounding job! #3846 handles #6 or 4 *bare* wire . . . #3847, #8, 6 or 4 *armored*. Both make a tight, lasting, *non-crushing* connection to copper tubing . . . water pipe . . . ground rod—in ½" and ¾" sizes.

Tighten just *one* screw on a #3846 for an electrically sound, mechanically durable joint between wire and electrode. Tighten just one *more* screw on a #3847 for a lasting grip on the armor *too!*

One-piece construction—no loose parts to get lost. Ideal for installation in dark, cramped quarters. *UL approved, of course!*

ENGINEERED RIGHT... DISTRIBUTED RIGHT!

Ground Clamps #3846 and #3847 are typical of the many T & B quality fittings recently re-designed to give you outstanding performance at lowest installed costs. Like all T & B fittings, they're furnished under the T & B Plan 100% through your local T & B distributor.

THERE'S A T&B ENGINEERED PRODUCT for every wiring job in the complete T & B line of fittings for all conductors and raceways.

UL

THE THOMAS & BETTS CO.

INCORPORATED
34 Butler Street
Elizabeth 1, New Jersey

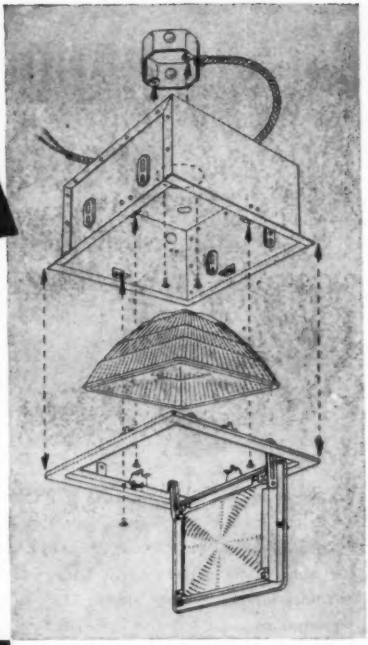
MANUFACTURERS OF ELECTRICAL FITTINGS SINCE 1898

The LIGHT-TIGHT DUO-FRAME

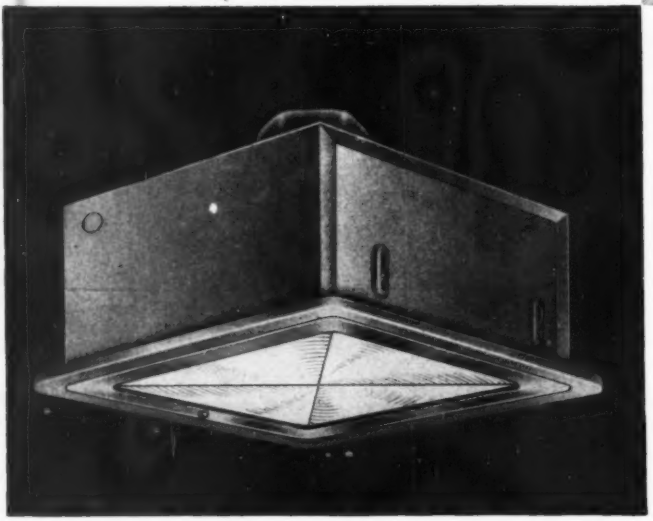
DAY-BRITE'S newest recessed lighting units

PREVENT DAMAGED CEILINGS...

MAKE LIGHT LEAKS IMPOSSIBLE...



Just mount these handsome, new Day-Brite fixtures and stop worrying about ceiling damage, paint scrapes, or unsightly finger marks . . . caused during installation, cleaning or relamping. Day-Brite's Duo-Frame brings you these advantages because the Duo-Frame is simply . . . two frames! The outer frame is fastened to the box after painting and plastering have been completed, and it remains in position during servicing. The inner frame, mounted to drop hinges, is easily removed for servicing. And this exclusive Day-Brite light-tight engineering eliminates all light leakage.



30 GREAT FEATURES INCLUDE:

Holophane Controlens* for maximum efficiency, even illumination and low brightness.

Die-formed, riveted and welded construction throughout.

Two sizes: Available for 8½" and 12" square Holophane Controlens,* vertical or horizontal lamp mounting.

Frame finished in Hot-Bonded Lustre Aluminum Enamel, rust-inhibited before painting.

For complete information on the new Duo-Frame write Day-Brite Lighting, Inc., 5402 Bulwer Ave., St. Louis, Mo.

*®The Holophane Co.

NOW, MORE THAN EVER

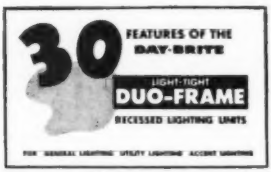
AMERICA MUST SEE WHAT IT'S DOING

IT'S EASY TO SEE WHEN IT'S

"DECIDEDLY BETTER"

DAY-BRITE

Lighting Fixtures



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For a quick look at all 30 big features ask for this free booklet.

THE BIG FACTS

There's amazing extra value in Cutler-Hammer Type D Safety Switches at no extra cost

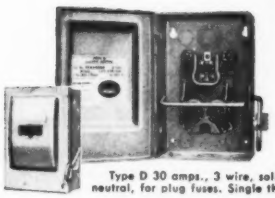
The big facts about the complete and comprehensive line of Cutler-Hammer Type D Safety Switches that impress electrical contractors and wholesalers most are the high quality of manufacture, and the dependability that keeps customers satisfied. These General Purpose Safety Switches are built up to a standard of excellence, not down to a price. They have ready acceptance for use with workshop tools, oil burners, stokers, laundry appliances, air conditioning and refrigeration units, feed grinders, compressors, etc., in homes, shops, farm and commercial buildings, and service entrance use.

Some of the features that mean better performance on the job are: "Easy-tight" wire holes on terminals that provide quick, solderless connections; inorganic base that will not carbonize or disintegrate, and dissipates heat from the fuses, resulting in cooler operation; double faced contacts with wiping, self-cleaning action that insure cool, continued performance; single break action with no needless overloading of switch mechanism; sturdy shock-resistant cases; provision for padlocking in the off position; ample concentric knockouts; ample wiring space.

When experienced electrical men want reliability, they insist on Cutler-Hammer Safety Switches, carried in stock by distributors everywhere.

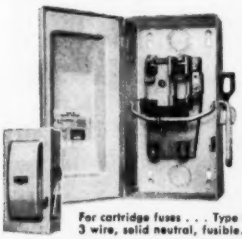
CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

Broad Range of Sizes, Types and Enclosures

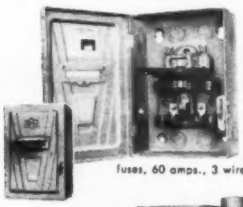


Type D 30 amps., 3 wire, solid neutral, for plug fuses. Single throw.

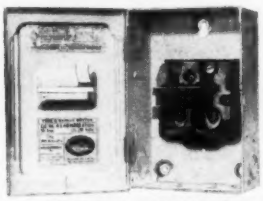
Type D 30 amps., 2 poles fusible, for plug fuses. Single throw.



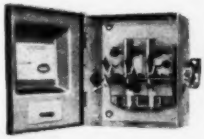
For cartridge fuses . . . Type D 60 amps., 3 wire, solid neutral, fusible.



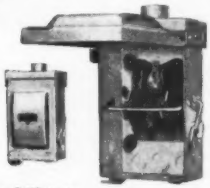
Front operated—Type D for cartridge fuses, 60 amps., 3 wire, solid neutral.



D-Puller Front operated—Type D for plug fuses, 30 amps., 2 poles.

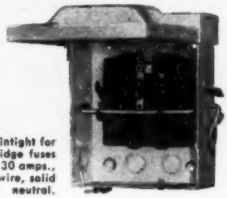


For cartridge fuses . . . Type D 30 amps., 3 poles, fusible.



Raintight Type D 30 amps., 3 wire, solid neutral, for plug fuses.

CUTLER·HAMMER
SAFETY SWITCHES
C·H



Raintight for cartridge fuses . . . Type D 30 amps., 3 wire, solid neutral.

EASY TO SELL...

LPI

Luv-K-Lok

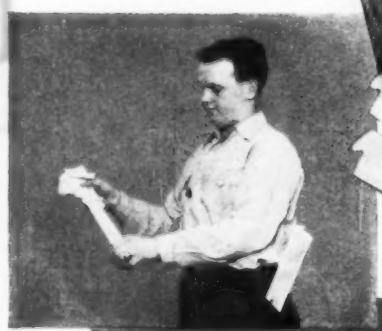
(PATENTS PENDING)

AN EDWIN D. TILLSON DESIGN

One hand does it!

LPI

Removable louvers slip in and out like safety razor blades. A quick wiping action cleans both sides of blade simultaneously. Fixture shown here can be cleaned in 3 minutes — about one-tenth the usual time. An *exclusive* LPI patented invention.



Write for FREE LPI HANDBOOK to
Lighting Products, Inc., Highland Park, Ill.

EASY TO INSTALL

As you know, there is a 50% reduction in foot candles *unless* louvers and shielding surfaces are cleaned regularly. Trouble is, frequent cleaning of old-style louvers costs a fortune. Now, at last, Luv-R-Lok, an *exclusive* LPI invention, solves the problem with louvers that slip in and out with finger-tip ease. Here is a sales pitch that will make you a hot bidder on every job you go after. Mail coupon for the LPI Handbook and get the full story. It's FREE.

Lighting Products, Inc., Highland Park, Ill.

EASY to hang, a feature that easily saves you 50% on labor costs.

EASY to align: a special collar stem adjuster permits accurate alignment *in half the usual time.*

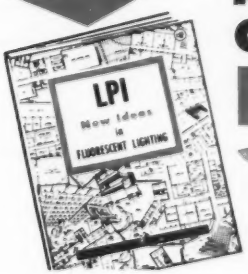
EASY to handle: Luv - R - Lok, without loss of strength, is as much as 25% lighter in weight than old-style fixtures.

EASY to install in continuous rows: ingenious time - saving joiner bridge saves you time and labor.

EASY to replace lamps. Simply lift off removable plastic sides—and the job is done in a jiffy!

FREE HANDBOOK

THE LPI HANDBOOK, crammed with New Ideas in Fluorescent Lighting, is a valuable sales tool that will show you how to cut your costs and make more money. Mail coupon NOW.



MAIL COUPON NOW

Lighting Products, Inc., Highland Park, Ill.

Okay, send me your Free LPI Handbook. I am interested and want to know more, but this request obligates me in no way whatever.

FIRM NAME_____

My Name_____

ADDRESS_____

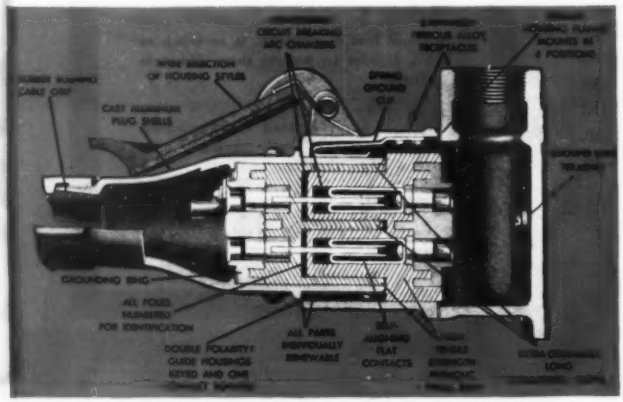
CITY_____ ZONE_____ STATE_____

SAFE • DURABLE • DEPENDABLE

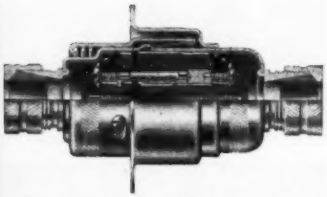
PYLE-NATIONAL Heavy Duty Plugs and Receptacles

FOR PORTABLE ELECTRICAL EQUIPMENT

Pyle-National plugs and receptacles are built to withstand the most severe operating conditions, as proven by years of remarkably dependable service in a wide variety of industrial applications. The many substantial construction features of this extensive line of plugs and receptacles and the high quality of materials and workmanship insure safe operation, uninterrupted service and long life.


CIRCUIT BREAKING ARC CHAMBERS
WIRE SELECTION OF HOUSING STYLES
SPRING GROUND CLIP
CAST ALUMINUM PLUG SHELLS
GROUNDING RING
ALL POLES NUMBERED FOR IDENTIFICATION
ALL PARTS INDIVIDUALLY REMOVABLE
DOUBLE POLARITY GUIDE HOUSINGS KEYED AND ONE

QuelArc* • *Circuit Breaking Series* **Unique partitioned insulation provides long insulated paths through air and across surfaces for exceptional protection in these current rupturing devices. Cast metal housings, high grade insulation and individually renewable contacts insure long service life. Ratings 20, 30, 60, 100 and 200 amperes, 250 volts DC, 600 volts AC—2, 3, and 4 pole—grounded through shell or extra pole. Threaded cap, plain and hinged spring door housing styles are available.**



Interchangeable reversible contact units. 1, 2, 3, 4, 6, 8 pole

Triploc* *and Multiple-Circuit Series*

A line of exceptional versatility, unequalled in the heavy duty field, with a virtually unlimited number of assembly combinations for varied applications. Offers a selection of 1, 2, 3, 4, 6 and 8 pole contact units which are interchangeable and reversible in any single set of housings. Many types of housings available of pressed steel with automatic lock and of cast metal threaded for watertight gasket seal. Multi-Circuit housings with 2, 3 and 4 contact units available for combinations up to 32 poles. Ratings 15 and 20 amperes, 250 volts DC, 460 volts AC—circuit breaking. Pressed steel fusible and fuseless plugs measure only 1 13/16" outside diameter.

Midget Triploc* *Series* **Same construction features as Triploc except for much smaller outside diameter of plug shell—only 1¼". Interchangeable and reversible contact units—2, 3 and 4 pole—are of the flat blade type. Rated 10 amperes, 250 volts; 15 amperes, 125 volts.**

General Purpose *Series* **Available with cast metal housings in many types for circuit breaking and disconnect service. 30 amperes, 125 volts DC, 250 volt AC—1, 2, 3, 4, 5 and 6 pole. 60 amperes, 250 and 600 volts—3, 4 and 5 pole. 100 ampere, 250 and 600 volts—2, 3 and 4 pole. Also many special types, fusible and fuseless, for varied applications.**

*TRADEMARK REG. U. S. PAT. OFF.

THE PYLE-NATIONAL COMPANY

1344 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

BRANCH OFFICES AND AGENTS in principal cities of the United States and Canada. • EXPORT DEPARTMENT: International Rail Supply Co., 30 Church St., New York. • CANADIAN AGENT: The Holden Co., Ltd., Montreal

CONDUIT FITTINGS • FLOODLIGHTS • TURBO-GENERATORS • GYRALITES • MULTI-VENT AIR DISTRIBUTION

A user REPORTS...

After their satisfactory experience with the 500,000 C. M. insulated aluminum cable (at right), National Supply Co., Torrance, Cal., says, "We will seriously consider aluminum when similar installations are planned." These cables, insulated with RH 600 v. U. S. Paracore, are connected to bus, from which they carry current to distribution panels for such heavy loads as welding machines, shears, rolls and other equipment.

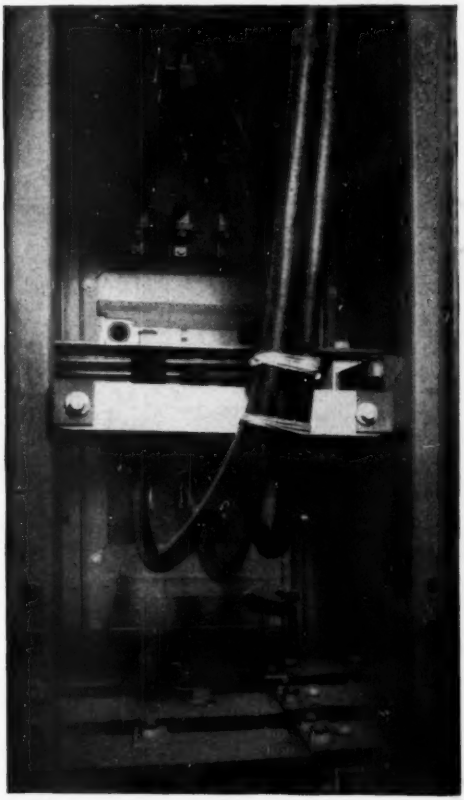


figure it in ALUMINUM and you figure it low

When you plan new production lines, add feeders for heavier loads, get prices both ways—in aluminum and in copper. You'll find you can make worth-while savings with aluminum . . . and installation is faster, easier because of aluminum's light weight.

Although the rearmament program restricts the use of aluminum, we are ready to help you with the planning for trouble-free, low-cost wiring.

FREE INSTALLATION BOOK

"Questions and Answers" on installation of aluminum conductors. Write for it now — ALUMINUM COMPANY OF AMERICA, 1775K Gulf Bldg., Pittsburgh 19, Penna.

Aluminum Conductors

ALCOA

of ALCOA EC ALUMINUM are made by leading manufacturers

AUTH — A COMPLETE Source for Signaling, Communication and Protective Equipment

You save time, temper and money by eliminating purchasing, delivery, transportation and inventory headaches — and you give your customers faster, more complete service — when you can get a complete line of signaling, communication and protective devices and equipment from one reliable source. Auth is such a reliable central source, and has been since 1892. Over 58 years the word of *AUTH*ority for tested equipment, designed for long, trouble-free service.

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Electrical Signaling, Communication and Protective Equipment for Housing, Hospitals, Schools, Offices, Ships and Industry.

SINCE 1892 AUTH

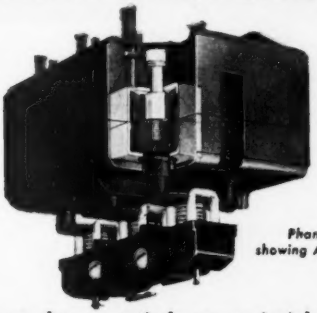
AUTH ELECTRIC COMPANY, INC.
34-20 45TH ST., LONG ISLAND CITY 1, NEW YORK

It's All NEW! CLARK TYPE CY AC Motor Starter

...with the sensational NEW multi-turn magnetic blowouts...

...and TWIN-BREAK CONTACTS

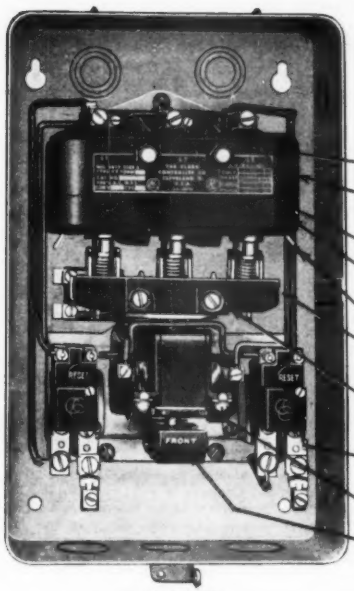
Here, for the first time is a rugged AC magnetic starter that provides the extra protection and dependable operation of "Mill-Type" heavy-duty construction and design.



Phantom view showing Arc-shield

CLARK FIRST!

Type "CY" starters employ an entirely new principle of arc interruption. The arc is extinguished by the effect of the blow-out coil, *concentric with the contact.* The magnetic field quenches the arc either by lengthening or confining it. In its *forced rotation* it moves continually from a hot to a cold spot—minimizing burning or pitting of contacts. The ingenious design of the arc chamber prevents carbonization and the accumulation of hot gases between wiring terminals—minimizing phase-to-phase failures*.


One piece upper arc shell protects terminals from hot gases
Magnetic arc interrupters with steel arc chambers
Pressure type terminals line and load
Arc shields of inorganic non-carbonizing material
Finger clips for easy contact inspection
Silver double break control circuit contacts
Captive screws in contact arm
Melting alloy type overload relays
Easy coil replacement—only two screws and one pin to remove
Vertical lift magnet with steel guide uses no springs
FRONT

Open View.

The Maintenance Man's Dream!

- **No filing, dressing or cleaning of contacts!**
- **No tools necessary to inspect contacts!**
- **Easy to change moving contacts!**
- **Stationary contacts changed quickly!**
- **Remove only two screws and one pin to change coils!**
- **Remove only four screws to take out stationary magnet frame!**
- **Power circuit contacts available with springs in complete packaged service kits for ease in stocking!**

*Magnetic blow-out coils are used on all size 2 and 3 Type "CY" starters. The same Mill-Type construction is used on sizes 0 and 1.

Available Through **CLARK** *Distributors.*

THE CLARK CONTROLLER CO.

ENGINEERED ELECTRICAL CONTROL • 1142 EAST 152ND STREET, CLEVELAND 10, OHIO

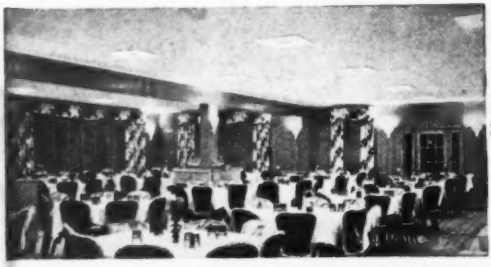
This high-intensity installation of surface-mounted SKYLIKE units was selected for the modernization of the Amesbury, Massachusetts, Public Library. Note the low brightness levels even at the light source . . . the effectiveness of the 90° shielding . . . the absence of harsh shadows and sharp light cut-off lines.

SKYLIKE® Lighting — "installation-proved"

IN SCHOOLS, OFFICES, STORES, AND PUBLIC BUILDINGS

Blending the soft, indirect light of silvered-bowl incandescent lamps with the modern look of fluorescent-type troffers, Silvray SKYLIKE units permit an almost unlimited variety of exciting new lighting applications.

As recessed, surface-mounted, or suspended units . . . in patterned groups or panels . . . for new construction or modernization you're sure to like the versatility, efficiency, and low cost of SKYLIKE fixtures.



A patterned group of recessed units in the dining room of the Bader Hotel in Spring Valley, N. Y. illustrates the way Silvray SKYLIKE fixtures fit 24" x 24" ceiling tiles. Note how the soft, even distribution of low-intensity light helps to create the desired mood of cheerful hospitality.

Look at these typical installations!

(Unretouched photographs, using room light *only*, demonstrate the unusually uniform distribution of light provided by SKYLIKE fixtures.)

Architect Harvey P. Clarkson of Petroff and Clarkson, New York, N. Y. specified this suspended Silvray SKYLIKE installation for the conference room jointly used by the Tea Association and the Tea Bureau, Inc., at 500 5th Ave. Providing a medium lighting intensity of approximately 35 foot-candles, these SKYLIKE units represent an initial investment saving of from ⅓ to ¼ the cost of competitive equipment offering comparable results. The lighter weight and internal simplicity of the fixtures also permits additional savings in installation time.

SKYLIKE fixtures assure adequate, comfortable illumination for employees of the Stewart Company in its Dallas, Texas, offices. The Stewart Company, a well-known distributor of Ford tractor and Dearborn farm equipment, also benefits from the unique construction of SKYLIKE units — construction that permits floor-level relamping with pole-type lamp changers . . . quick changes in light-distribution characteristics . . . and variable light output through interchangeability of 150- to 500-watt lamps.

Distributed by GraybaR

Send for complete SKYLIKE information. A comprehensive booklet describing the SKYLIKE system is yours for the asking. To get your copy, write Graybar Electric Company, Inc., Graybar Building, 420 Lexington Avenue, New York 17, N. Y.
S110-410

SKYLIKE LIGHTING INC.

How Okonite-engineered cables save money for the McCall Corporation

Engineers of the McCall Corporation, Dayton, Ohio, sought a means of reducing their insulated cable replacements on six printing presses. The ordinary cables used for supplying the gas ignition apparatus failed quickly because of temperatures ranging from 350 to 450°F. Monthly replacements of the standard rubber-insulated automotive ignition cable previously used gave rise to the following costs:

BEFORE

Cost of cable per year	**$650.00**
Labor in replacement	**900.00**
Yearly cost: materials and labor	**$1550.00**

In 1948, at the suggestion of an Okonite engineer, McCall installed Okonite's heat-resistant Okotherm cable. Since then, no replacements have been made under conditions of normal usage. Although the Okotherm cable was several times as expensive, experience has already shown that annual costs have been reduced to a mere fraction of the previous cost, as follows:

NOW

Cost of cable per year	**$142.00**
Labor on installation	**37.50**
Total yearly cost using Okotherm	**$179.50**

...a saving of 88.5%

• • •

Stories like this are not unusual in the file of actual case histories at Okonite. For the broad research and design and manufacturing skills which have developed such long-lived, trouble-free cables for normal use, have also developed many types for highly specialized applications.

These facilities are available to *you,* to help solve any difficult cable problems arising in *your* operation. Don't hesitate to call in your nearest Okonite representative, or write The Okonite Company, Passaic, N. J.

OKONITE OKONITE SINCE 1878

THE BEST CABLE IS YOUR BEST POLICY

insulated wires and cables

9188

RECOMMENDED COMBINATION
For Lighting Heavy-Industry Plants

No. 693-AL-HS

HIGH BAY LIGHTING

HIBAY* lighting applies to mounting heights exceeding 25 feet and finds its primary use in Mills, Shops, Hangars, etc. Equipment is designed for 500, 750, 1000 and 1500 Watt Incandescent lamps as well as for the newer type 400 and 1000 Watt Mercury lamps. The prismatic reflectors give highest efficiency, and their smooth inner surfaces prevent permanent depreciation. Heavy-duty rugged construction guarantees safe, trouble-free operation.

LOW BAY LIGHTING

LOBAY* lighting with its variety of light distributions—concentrating, intensive and extensive—features prismatic reflectors for all kinds of light manufacturing. Designed with and without aluminum covers, these reflectors use Incandescent and Mercury lamps. The wide selection of light patterns produces highest illumination for any arrangement of machinery or equipment.

No. 645-AL

OUTDOOR LIGHTING

REFRACTOLENS* units, applicable for many outdoor uses, can be flushed in the wall or mounted on the surface. Their compound REFRACTOLENS, smooth on the inside surface with the prismatic optics sealed in an airtight chamber, give 180° lateral spread. Designed for Incandescent (100-1000 watt) and the 400 E-H1 Mercury, high illumination level is provided over large areas requiring wide spread of light.

No. U-850

Based on the economical operation of mercury in combination with incandescent lamps or mercury alone with incandescent stand-by, Holophane has developed HIBAY, LOBAY, and Outdoor Lighting Equipment designed for the severe conditions typical of steel mills and other heavy-industry plants. Twin and triple units are also available.

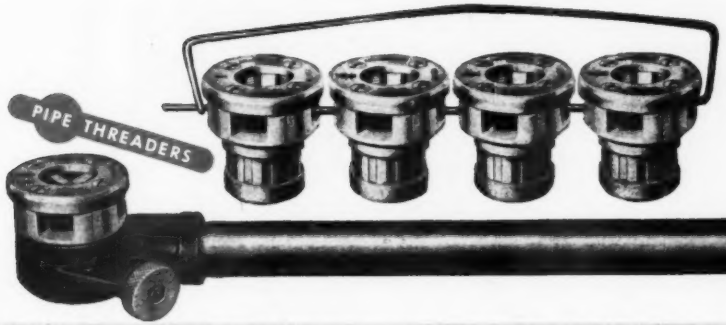
Holophane

*Reg. U. S. Pat. Off.

HOLOPHANE COMPANY, INC.

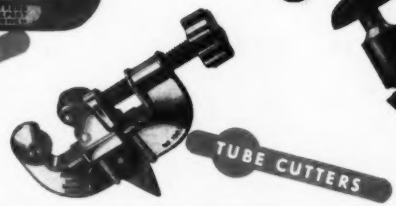
Lighting Authorities Since 1898 • 342 MADISON AVENUE, NEW YORK 17, N.Y.

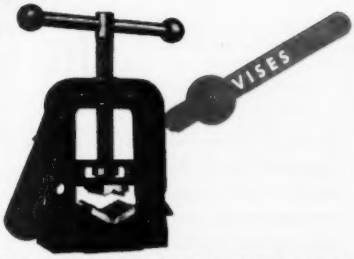
THE HOLOPHANE COMPANY, LTD., THE QUEENSWAY, TORONTO 14, ONTARIO



EVERY JOB GOES WELL *with* ARMSTRONG-BRIDGEPORT *Job-proved* PIPE FITTERS' TOOLS

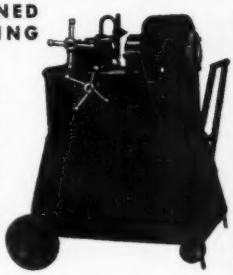
A PRODUCT OF CAPEWELL





MORE WORK IN LESS TIME AND WITH LESS EFFORT WITH THE VOSPER DESIGNED PORTABLE PIPE THREADING MACHINE

The Papoose is a 2" heavy duty power pipe and bolt threading machine, for high speed pipe and bolt threading, cutting and reaming. It has quick opening adjustable die heads, high speed steel segments, and can cut 2" pipe nipples 2½" long without a nipple chuck. Portable and easy to handle, it can be wheeled right to the job.



9CAB1

THE CAPEWELL MANUFACTURING CO.
64 Governor Street, Hartford, Connecticut

Gentlemen: Please send me more information on

☐ Pipe Tools; ☐ Pipe Threading Machines.

NAME _____

COMPANY _____

ADDRESS _____

_____

"No Strangle Holds — No Grunts, No Groans"

No husky bruisers are needed on your crew when you work with Pittsburgh Permaflector Lighting Units. All parts fit together easily, quickly, compactly. Fluorescent Units are wired complete, ready to install; knockouts for lead wires and mounting are clearly marked; inline installations can be aligned perfectly. Incandescent Units are simple to assemble into desired arrangements and combinations for every lighting need. Standard Units are available to fit into fluorescent troffer and luminaire assemblies.

Next time—whistle while you work. Use time and labor-saving Pittsburgh Permaflector Lighting Equipment.

The
MONROE 5000 SERIES

4 & 8 FT. FLUORESCENT LUMINAIRES FOR EFFICIENT LIGHTING

ALL YOU MOUNT IS A BARE CHASSIS

Units are mounted by one man. Hangers provide for vertical, lateral and lengthwise adjustment.

"Pittsburgh" Permaflector

Pittsburgh Reflector Company

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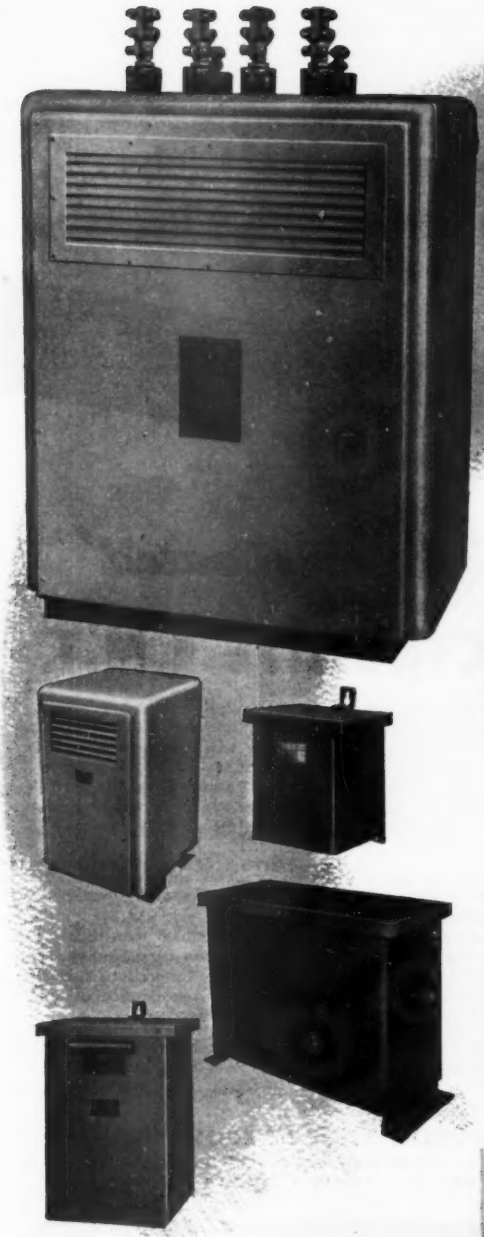
Manufacturers of Fluorescent and Incandescent Lighting Equipment

DISTRIBUTED BY ELECTRICAL WHOLESALERS EVERYWHERE • PERMAFLECTOR LIGHTING ENGINEERS IN ALL PRINCIPAL CITIES



MORE KVA PER POUND!

Lightweight, dry-type transformers save space, cut installation costs. 3 through 167 kva, single phase, or 9 through 225 kva, three phase.

They're lighter and smaller! Compact, completely ventilated coils on Hipersil® cores—neatly enclosed in sheet steel cases for convenience of mounting, cleanliness, trim appearance.

Add all this to the savings inherent in dry-type transformer design:

NO VAULTS. Mount them on the floor, walls, posts or overhead platforms, close to the load they serve. They're safe.

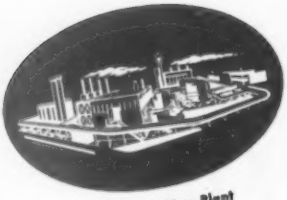
SIMPLIFIED MAINTENANCE. No liquids to store, filter or replace. No gauges, radiators, valves or gaskets to get out of order.

Westinghouse Dry-Type Transformers are available for voltage step-down or step-up applications or for phase changing. Types AJRB and AVRB (3 through 100 kva) have circuit breakers built into the high-voltage circuit, giving 3-way protection against damaging overloads or short circuits, cutting installation time up to 50%. Ask your Westinghouse representative for a copy of B-4428, or write Westinghouse Electric Corporation, P. O. Box No. 868, Pittsburgh 30, Pennsylvania. J-70607

YOU CAN BE SURE... IF IT'S

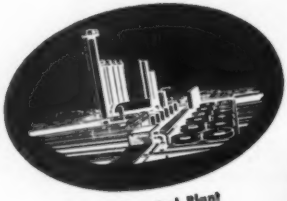
Westinghouse

DRY-TYPE TRANSFORMERS

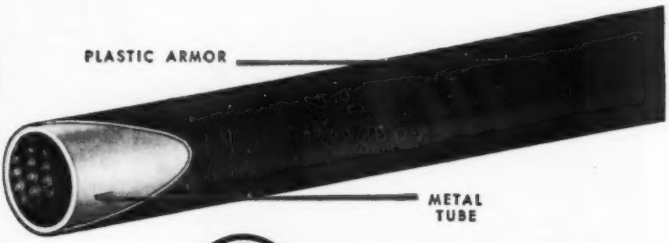


Meat-Packing Plant

for your toughest jobs . . . the raceway with 9 lives . . .



Chemical Plant

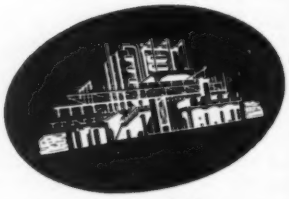


Sewage Disposal Plant

"Dekoron-Coated"

ELECTRUNITE E.M.T.

Wherever corrosion, moisture, and chemicals make short work of ordinary raceways, install Republic ELECTRUNITE "Dekoron-Coated" E.M.T. You'll increase the life of wiring systems as much as 10 times. In chemical plants, water and sewage disposal plants, food-processing plants, ELECTRUNITE "Dekoron-Coated" E.M.T. is running up savings in dollars and time wherever regular raceway material must be replaced due to the corrosive action of chemicals and fumes.



Salt Plant

An extruded coat of polyethylene encases light-and-strong ELECTRUNITE E.M.T. in an end-to-end armor that is impervious to almost everything from salt spray to hydrofluoric acid. ELECTRUNITE "Dekoron-Coated" E.M.T. is quickly assembled with regular threadless compression fittings. An application of polyethylene or vinyl backed electrical tape quickly seals connections fume-tight to maintain the end-to-end corrosion-resistance of an ELECTRUNITE "Dekoron-Coated" E.M.T. installation.

Get additional facts about this corrosion-resistant ELECTRUNITE E.M.T. that includes the easy-to-install features of regular ELECTRUNITE E.M.T. . . . plus longer life in tough installations. Write today for bulletin DEK-10.

REPUBLIC STEEL CORPORATION
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FREE BULLETIN

gives performance and installation data on ELECTRUNITE "Dekoron-Coated" E.M.T. Write for your copy today.

Republic
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"Dekoron-Coated" E.M.T.

LIGHTWEIGHT THREADLESS RIGID STEEL RACEWAY

Not, PLEASE, In the Name of Fairness

Our national Office of Economic Stabilization has adopted a policy of gearing wages to the cost of living. We are told that "escalator clauses," which provide that rates of pay shall be adjusted to take account of changes in the cost of living, will be generally approved.

If the adoption of this policy had been announced as a frank concession to political expediency, it would have been quite understandable. There may very well be votes, lots of them, in a policy which purports to protect the income of a large group against loss through the price inflation caused by the defense program.

A case might even have been made for a policy of approving escalator clauses on grounds of production expediency. The leaders of some three million organized workers now covered by such clauses have indicated that they would fight to the limit to keep them and thus maintain "real wages," that is, wages measured by their purchasing power. The leaders of other organized groups have indicated they would fight to get the benefit of such clauses. Denial of them might mean serious strikes.

Justified "in Fairness"

However, the policy of approving escalator clauses was not based on these relatively low grounds of expediency. It was justified on high moral grounds, on grounds of "fairness." In the words of the President's Council of Economic Advisers, "maintenance of real wages during inflation cannot in fairness be disallowed."

That proposition is false.

It would be truthful to say, "maintenance of real wages during inflation cannot in fairness be allowed."

The truth of the corrected proposition becomes evident immediately when you take a look at the basic nature of the inflationary problem created by defense mobilization.

We are devoting a large share of our national production to defense. The share is now scheduled to hit about 20% in 1952.

Since we are not able to increase our total production fast enough to meet defense needs

in addition to civilian needs, that means a cut in the supply of goods and services that is available for civilian consumption. But the money paid out for the production of defense materials is added to that which is available to buy civilian goods.

Thus, more money is put into the hands of the people to buy less goods. So prices go up. That is inflation.

If one group of people then is granted enough additional money to offset the price increases — and that is the purpose of an escalator clause — and thus can continue to buy as much as they have been buying right along, less goods will be left for other consumers who are not getting this advantage. That is palpably an unfair distribution of the sacrifices necessitated by defense mobilization. In fairness, therefore, maintenance of real wages in inflation cannot be allowed.

Organized workers were not the first, of course, to get the benefit of an automatic adjustment to take account of the increased cost of living. The farmers got theirs first. The price parity formula is, in essence, an escalator clause. The federal government underwrites increases in the prices of the things farmers sell in order to match increases in the prices of the things they buy.

Crucifying the Helpless

As matters stand, two groups are without benefit of escalator clauses. One group is composed of manufacturing firms. While they have not been nearly as successful as the misleading reports of "record-breaking profits" suggest, they have been able to look after themselves fairly well — thus far.

But one group is completely without protection. It is that numerically large but politically unorganized mass of people — many of them old and relatively helpless — who are trying to live on pensions, annuities and other fixed incomes derived from their savings. They are at the end of the line when the increased costs of inflation are passed along. They have no one to whom they can pass the buck. They are being progressively pauperized by the continuing inflation caused by progressive boosting of costs and hence prices.

With the present line-up of pressure groups in Washington, protection for the principal victims of inflation — those who have saved for a rainy day only to find inflation has blown away the roof — is obviously an extremely difficult business. But to have even temporary insulation against inflation granted to powerful groups in the name of fairness should be offensive to the nostrils of a nation that presumes to assert the moral leadership of the Western World.

The only really fair way to handle inflation is to prevent it. But once it is under way, fairness demands that the burdens be as evenly distributed as practicable.

An escalator clause — or a farm parity provision — is explicitly a device to enable the group favored by it to escape the burden of inflation. Whatever concessions we feel we must make to political pressures or production expediency, let us at least be honest enough not to invoke "fairness" as justification for so arbitrary a discrimination in the distribution of the defense burden.

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Insulating News

News of G-E electrical insulating developments that may be important to your business.

"HIGH-SOLIDS" G-E GLYPTAL* RED COVERS WITH ONE COAT, SAVES

Venerable G-E Enamel Proves Tops for Vital Defense Jobs

As an insulation protection finish for electrical rotating equipment, *one coat* of G-E Glyptal Red enamel covers better than two or more coats of most ordinary enamels. A high solids content of 65% and excellent relative build make this possible.

Electrical repairmen appreciate that, although they use less of it, G-E Glyptal Red provides outstanding protection. It has excellent resistance to heat, moisture, chemicals, oil, acid and salt water. A thoroughly time-proven product, G-E Glyptal Red is specified time and again in vital defense equipment where severe operating conditions might be encountered.

Remember these two important reasons for using G-E Glyptal Red:

1. **You get *outstanding protection.***
2. **You need *fewer finishing* coats with G-E *Glyptal Red.***

Write for details, specifications, properties, prices —to Section AB-4, Chemical Division, General Electric Company, Pittsfield, Massachusetts.

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Covering the Field—G-E Glyptal Red has long been accepted as the outstanding insulation protection finish on electrical rotating equipment. Best protection is obtained by using thin coats—which also results in substantial savings in cost of materials.

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Silicone Insulation • Insulating Varnishes
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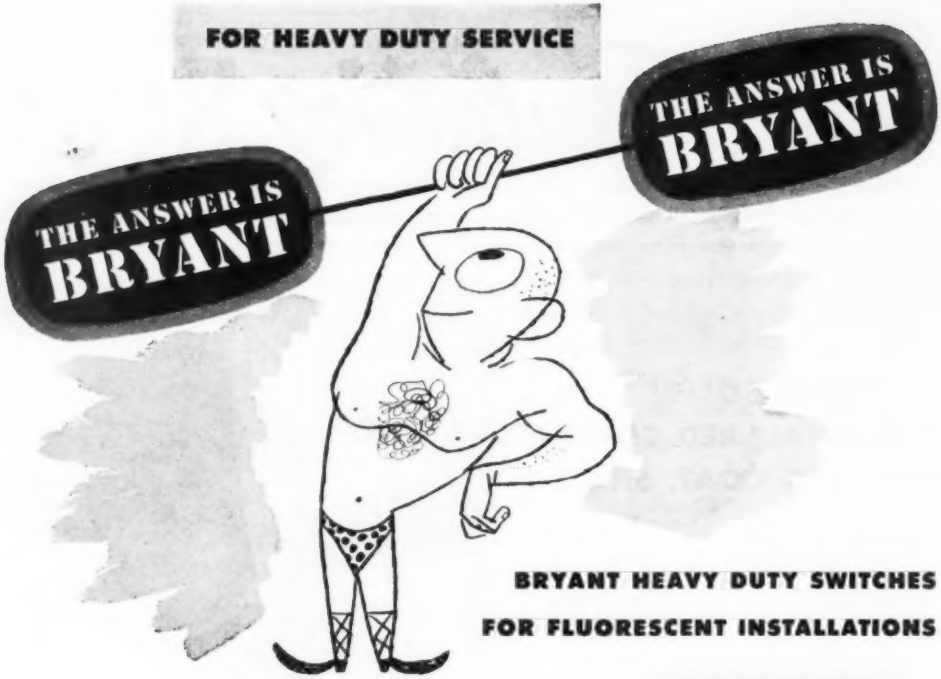
ALSO—look to General Electric for a complete line of laminated sheets, tubes and rods, and molded laminates with cloth, paper, glass fabric or special bases for a wide range of insulation and other industrial uses.

You can put your confidence in

GENERAL ELECTRIC

FOR HEAVY DUTY SERVICE



BRYANT HEAVY DUTY SWITCHES FOR FLUORESCENT INSTALLATIONS

Fluorescent lighting circuits are of the inductive type . . . so it is highly important that **heavy duty switches** control these circuits . . . switches that can easily handle heavy loads.

Bryant 20 and 30 ampere switches, designed for service in industrial, institutional and commercial installations where severe loads are encountered, will give long, trouble-free performance.

NO. 5861 LINE—Bakelite enclosed cups (1-15/32" deep) in single pole, double pole and 3-way types, with brown and ivory handles. Also available in lock and momentary contact types.

NO. 5421 LINE—Bakelite enclosed cups (1-15/16" deep) in single pole, double pole, 3-way and 4-way types, with brown handles. Also available in lock type.

NO. 5431 LINE—Bakelite enclosed cups (1-15/16" deep) in single pole, double pole, 3-way and 4-way types, with brown handles. Lock type also available.

20 AMPERE FLUSH SWITCHES

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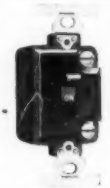
No. 5421 Line

No. 5431 Line

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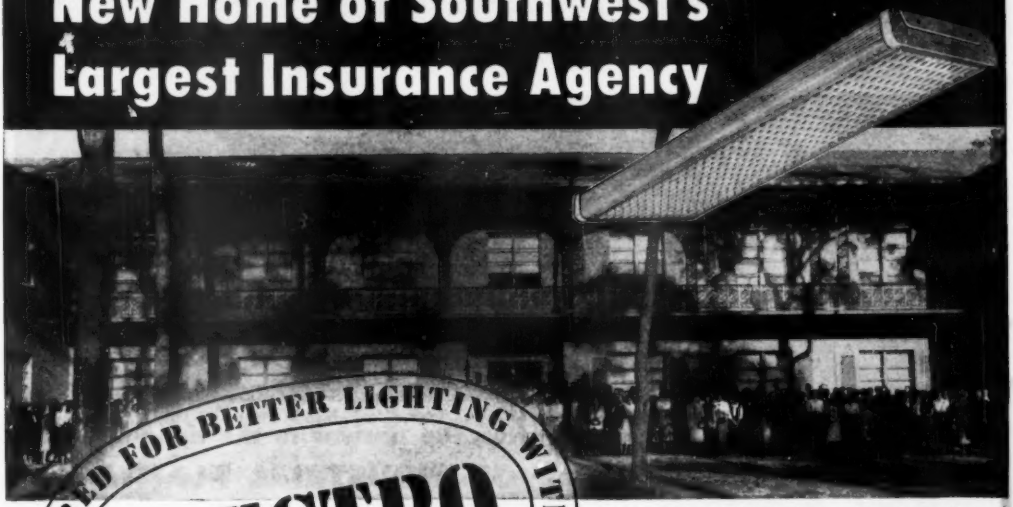

INSURED FOR BETTER LIGHTING WITH ELECTRO SKYLOUVER INSTALLATION

New Orleans-styled Facade of Cravens, Dargan & Co. Building

THE forward-looking policies of Cravens, Dargan & Co., which have been responsible for many insurance "firsts" are reflected in their choice of lighting for this new, handsome, New Orleans-styled office building. Located on a two and one-half acre heavily wooded site, the three story main building "hides" a fourth floor with 4,000 sq. ft. of storage and filing space.

This Magnificent New Structure features: An overall installation with approximately 700 #1035 3-lite, 40-watt Skylouvers that maintain 70 foot candle intensity.

Both the main building and annex are designed to support additional floors to take care of future expansion needs.

- **More attractive—lower maintenance... with Luxtrex Styrene Louvers that won't warp, discolor, chip or crack.**
- **More light...translucent side panels transmit more light, reduce light loss.**
- **More flexible...ELECTRO "Basic Unit" fixtures permit easy interchangeability of luminaires.**
- **More economical...exclusive ONE MAN "SPEEDY HANGER" cuts installation man-hours 50%.**

ARCHITECT: **WYATT C. HEDRICK, INC.**
5201 Fannin Street, Houston, Texas

"Electro Skylouver was our choice because of its modern styling, increased lighting efficiency and the low cost of maintenance and installation."

MR. L. O. EIFFERT, *Electrical Engineer* **of Wyatt C. Hedrick, Inc.**

CONTRACTOR: **KELSO-BURNETT ELECTRIC CO.**
2302 Jefferson Street, Houston, Texas

ELECTRO MEANS...FORESIGHT IN FLUORESCENT LIGHT

ELECTRO MANUFACTURING CORPORATION

2000 West Fulton Street, Chicago 12, Illinois

SANGAMO the Time Switch with the *Automatic Memory*...

A Sangamo Astronomic Time Switch controls the circuits for the protective flood and yard lighting in this defense factory. Other types are available for practically any conceivable industrial use.

The operation of this Sangamo Astronomic Time Switch automatically compensates daily in accordance with sunset and sunrise.

is often the answer to the timing needs OF INDUSTRIAL PLANTS

The growing shortage of available industrial manpower makes automatic devices with which to control manufacturing processes more important than ever. The Sangamo Time Switch is such a device. It will solve practically any problem concerning daily sequence timing in industry. Protective floodlighting control is a typical example where the Sangamo Time Switch eliminates the need for human attendance. So is the use of these switches for the control of pre-heating before workshifts, or the continuance of certain process cycles after workshifts. Below are a few suggestions where Sangamo Time Switches can serve industry.

INDUSTRIAL APPLICATIONS

For daily pre-heating:

Lead pots for solder operations.
Zinc for injection molding.
Type metal in type foundries.
Dies in plastic molding presses.
Glue in woodworking shops.
Tanks for galvanize dipping.
Electric ovens and furnaces.
Infra-red paint dryers.
Electronic testing equipment.
Soldering irons on assembly lines.

For daily circuit control:

Yard floodlights.
Runway and hall lights.
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Water softeners.
Mixing equipment.
Electric doors and gates.
Air conditioning.
Alarm systems.
Exhaust fans.
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Two-level thermostats.

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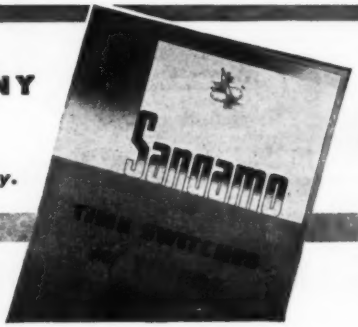


ST51-7

Defense Production

makes more important than ever the Specification of Lighting Units that meet

RLM High Quality Standards

for Efficiency, Durability and Uniformity

Vital to defense and essential civilian production, are lighting units that *can be depended upon* to provide the right quantity and quality of light, economically, dependably and with a minimum of servicing need and maintenance cost.

Defense production demands lighting equipment with the ability to *sustain its rated light output* efficiency over hundreds of cleanings so that the proper high illumination levels may be maintained. It demands the *durability* found so essential to industrial lighting and the avoidance of production interruptions and inefficiency due to abnormal wear, distortion or breakdown. It demands fullest *protection from glare* through proper diffusion and shielding.

All of these, and many other conditions for proper lighting of defense plants can be met through the specification of RLM-Labeled Lighting Units. All units bearing the RLM Label are warranted by Electrical Testing Laboratories to conform to the minimum standards established by the RLM Standards Institute for efficiency, durability and uniform quality.

FREE RLM BOOKLETS containing complete specifications for all RLM-Certified Industrial Fluorescent and Incandescent Lighting Units and the names of all manufacturers of RLM-Labeled Units may be obtained by writing: RLM STANDARDS INSTITUTE INC., Suite 819, 326 West Madison Street, Chicago 6, Illinois.

Specification of RLM-Labeled Units Assures Conformance to ALL these Essentials of Defense Production Lighting

RLM
ELECTRICAL TESTING LABORATORIES, INC.

DIFFUSION WITH HIGH REFLECTION FACTOR
RLM Porcelain-Enameled Steel Reflectors must have a mean reflection factor of 82% . . . an assurance of more light for the money. Porcelain enamel reflecting surfaces *diffuse* light from the lamp and help provide proper *quality* of illumination.

TOP QUALITY PORCELAIN-ENAMELED REFLECTORS
RLM Reflectors are built of not less than .032" reflector steel covered with .025" fused on porcelain enamel that will not chip, corrode or deteriorate under industrial operating conditions.

APPROVED REFLECTOR DESIGN
Reflector design of RLM Units conforms to specifications embodying approved practices of illuminating engineering.

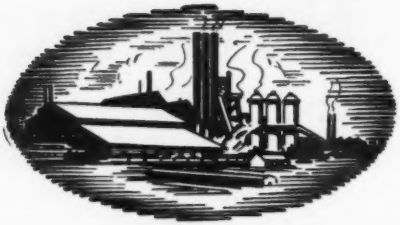
HIGH POWER FACTOR BALLASTS
RLM Standards specify the use of certified ballasts which last longer, because they are designed to prevent excessively high temperature operation.

UNIFORM QUALITY
RLM Standards insist on the maintenance of uniform quality as to materials and construction, thus assuring the buyer of uniform lighting performance from each unit installed.

RLM STANDARDS INSTITUTE
INCORPORATED

In Interest of Better Lighting Equipment Manufacture

RA438



1900 ★ THE MIRACLE OF AMERICA ★ 1950

Freedom and Progress

It's no stretch of the imagination, rather, robust realism to call our past half century a Miracle—U. S. A.

America has set an amazing record of progress in 50 years—but a moment in the history of civilization. A record unequalled by any other political or economic system.

Merely by broad brush strokes, we can all visualize this miracle. Remember the crystal set, the hand-cranked car, the biplane? A far cry from our FM radio, television, hydro-matic drive and supersonic planes.

And here's another phase of the miracle that went hand-in-hand with these and the myriad of intertwined technological advances—ranging from the radio telephone and Bakelite to the X-ray tube and teletype . . . and to atomic energy and its untold potentialities.

- ★ Since 1900 we have increased our supply of machine power 4½ times.
- ★ Since 1900 we have more than doubled the output each of us produces for every hour we work.
- ★ Since 1900 we have increased our annual income from less than $2400 per household to about $4000 (in dollars of the same purchasing power), yet . . .
- ★ Since 1900 we have cut 18 hours from our average work week—equivalent to two present average workdays.

How did we do it? The basic cause for this composite miracle has been the release of human energy through FREEDOM, COMPETITION and OPPORTUNITY. And one of the most important results is the fact that more people are able to enjoy the products of this free energy than in any other system the world has ever known.

THIS IS THE MIRACLE OF AMERICA . . . it's only beginning to unfold.

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THE NEW

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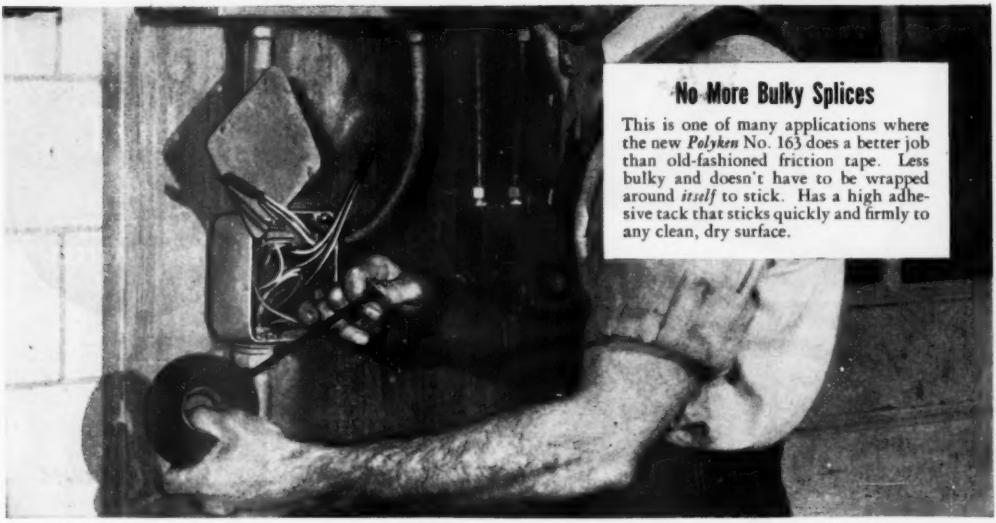

No More Bulky Splices

This is one of many applications where the new *Polyken* No. 163 does a better job than old-fashioned friction tape. Less bulky and doesn't have to be wrapped around *itself* to stick. Has a high adhesive tack that sticks quickly and firmly to any clean, dry surface.

After 70 years—an electrical tape that costs less than friction tape

This is the first new thing that's happened in the friction tape field in nearly a century—*Polyken* No. 163. An electrical tape that sticks to any surface as well as to itself. It has higher dielectric strength with less bulk. Forms a better moisture barrier. Doesn't fray. Sticks better and is easier and cleaner to handle.

All this, new *Polyken* No. 163 brings you . . . yet costs less than old-fashioned friction tape! See your Polyken distributor today.

Polyken, Dept. ECK, 222 West Adams St., Chicago 6, Ill.

For specifications and further information on this and other Polyken tapes, please send me your *FREE BOOKLET*, "Tape is a Tool."

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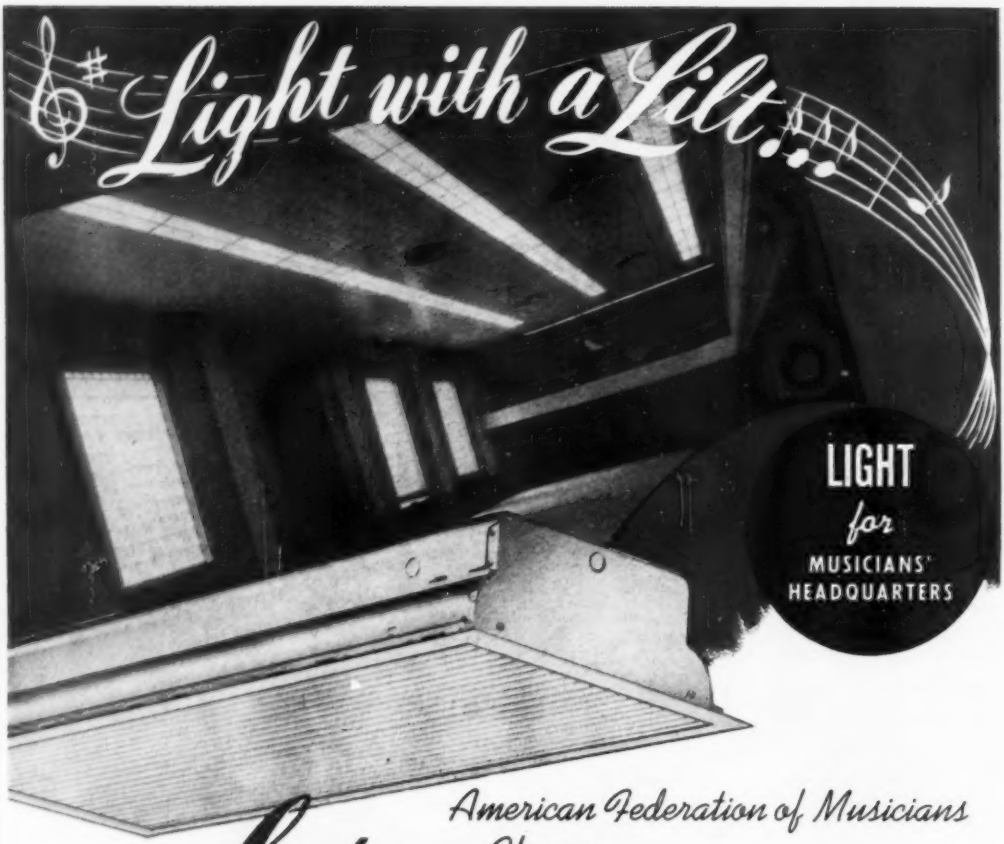
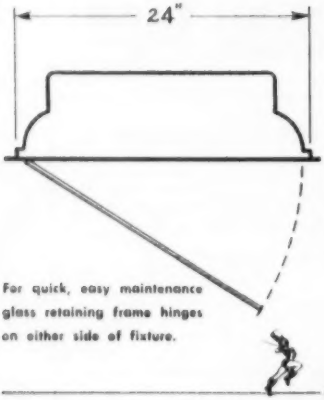
Polyken Industrial Tape, Department of Bauer & Black, Division of The Kendall Company

Light with a Lilt...



American Federation of Musicians Chooses...

Leader RECESSED TROFFERLITES



For quick, easy maintenance glass retaining frame hinges on either side of fixture.

Here was a difficult lighting problem from the start . . . large area . . . high ceiling . . . balcony on three sides which must have an unobstructed view of the "floor."

The answer? Leader RECESSED 24" TROFFERLITES! How well the job was done is quickly told by a view of the photo above. Note the ideal seeing conditions in both the main area and on the balcony.

Leader TROFFERLITES are made in regular or shallow types, in 12" widths as well as 24" . . . designed for use with two, three or four 40-watt lamps. Available as open, louvered, glass enclosed or baffled. Practically an unlimited number of combinations offer the architect or contractor wide flexibility in solving lighting problems.

Sold and installed by the better electrical dealers and contractors

Leader *America's No. 1 Lighting Equipment Manufacturer*

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Leader Electric—Western: 800 One Hundredth Avenue, Oakland 3, California
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Washington Report

The copper shortage is seriously acute. Demands are increasing, supply is diminishing. Domestic production is up slightly, but imports, accounting for about one-fourth the annual supply, have decreased. Reason: foreign price is above domestic, shipments are going to other countries.

NPA's big problem is equitable distribution to meet military needs first, then satisfy other big users—auto makers, communications, public utilities, construction, and producers of all types of electrical goods.

Electrical manufacturers were allocated more copper for the 4th quarter than for the 3rd in spite of shortages: brass mill up 19%, wire mill up 9%, foundry products down slightly. This reflects accepted essentiality of electrical products in military and industrial expansion programs.

Copper work stoppages in August resulted in loss of about 30,000 tons, less than 3% of annual supply.

Another copper end use order, similar to NPA Order M-12 (revoked), is under consideration, may be issued before this appears in print. It is designed to prohibit use of copper in all but highly essential products and to conserve copper for military and defense needs.

Aluminum bus duct will soon be made by one manufacturer, who has UL-approval. Peak demand for bus duct and other low voltage distribution equipment is still ahead, may require further substitution of aluminum for copper to meet demand. Switch to aluminum involves many technical problems but price and supply advantages may speed conversion.

Lamp manufacturers have been allocated materials for 4th quarter under CMP to produce $72-million of incandescent, fluorescent and mercury vapor lamps. Impact of orders for high-wattage and military-type lamps will slow down production of low-price household-type bulbs, industry members have told NPA. Tungsten supply, while still depleted, is improving, but lamp makers face loss of skilled workers due to slowdowns caused by shortages.

Fluorescent ballast manufacturers are being urged by NPA to substitute aluminum wire for copper wire wherever possible, to further conserve on copper. Aluminum windings have already been used in some power transformers, fractional motors, and in ballasts by one manufacturer.

Deficiencies in electric power are in prospect in the Pacific Northwest, Carolinas and North Central States in 1952, due to cutbacks in DEPA programs for expansion. NPA has indicated more controlled materials will be made available for power transformers during 1st quarter 1952, however, because of their importance to essential industrial expansion.

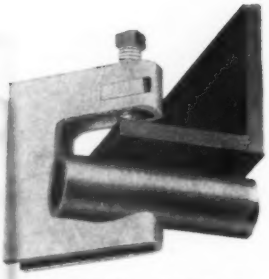
Building construction for 1951 is now expected to total about $29-billion, highest dollar value on record. Physical volume will be slightly less than for 1950. Due to materials shortages (mostly structural steel and copper), preliminary estimates are for 10% less physical volume in 1952.

Programs essentiality under mobilization plans will determine building construction approvals for many months ahead. Current appraisals of programs indicates essentiality in this order: expansion of industrial capacity for direct military production; expansion of facilities to produce more aluminum, iron and steel; other industrial expansion for essential products. All other types of construction will be curtailed sharply, including hospitals and schools. General commercial construction will be virtually stopped at least until 1953—with 10% or less of the 1951 rate permitted.

An NPA booklet, "Questions and Answers on Construction Under CMP," is available at NPA Washington offices and at all Department of Commerce field offices, which explains current controls in some detail.

ANNOUNCING a STEEL CLAMP for supporting STEEL CONDUIT from STEEL BEAMS

PRICE—No. 1247—24¢



SAME CLAMP — Conduit at RIGHT ANGLE to beams.

KINDORF

No. 1247 - 1248 - 1249 STEEL

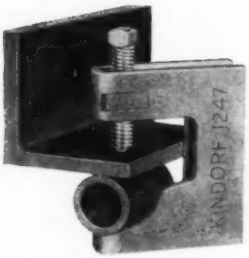
CONDUIT CLAMPS

Each of these 3 sizes of steel clamps supports conduit, either parallel with, or at right angle to beams.

No. 1247 supports ½ in. or ¾ in. conduit.

No. 1248 supports ½ in., ¾ in. or 1 in. conduit.

No. 1249 supports ¾ in., 1 in., 1¼ in. or 1½ in. conduit.



SAME CLAMP — Conduit PARALLEL with beams.

The above steel clamps are only ONE of several types of steel conduit hangers included in the

KINDORF B-SERIES CONDUIT HANGERS

for supporting single runs of conduit

—clamps with hook rods for fastening hanger rods to I-beams (load-rated).

—clamps with case-hardened set-screws for fastening hanger rods to structural steel (load-rated).

—clamps with swing connector for suspending hanger rods from purlins.

—hangers to support conduit in suspension (½ in. to 4 in. sizes).

—edge-type straps to clamp conduit across the edge of beams.

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OCTOBER . . . . at a Glance

IT'S A BIGGER RED FEATHER

The Red Feather, service symbol of more than 15,000 volunteer health, recreation and welfare services, is a bigger Red Feather this fall because it includes not only Community Chests but the United Defense Fund as well.

When you give your share through your town's UNITED RED FEATHER CAMPAIGN, you contribute to your own local Red Feather services, to the USO and to the emergency health and welfare agencies that provide help to people wherever defense efforts create special problems.

It's a bigger Red Feather than ever before and it needs your help more than ever before. GIVE GENEROUSLY to your UNITED RED FEATHER CAMPAIGN.

INDUSTRIAL LIGHTING

Efficient industrial production depends on good vision. And good vision depends on good illumination. Providing proper lighting for the hundreds of new industrial plants now being built, and improved lighting for the thousands of existing factories which are inadequately and poorly lighted, is a big job ahead.

Success in the attainment of increased productivity—a major defense mobilization goal—depends greatly on this job being done. Its importance cannot be overstressed. The lighting industry must first recognize this importance, then go out and do the best job it knows how in lighting the nation's productive facilities.

Techniques, the "how-to-do" methods of production lighting in common use today, and the fundamental design and application principles for providing better industrial lighting, form the framework for our annual special editorial feature section on Lighting Techniques. You'll find much useful information in its pages relating to your industrial lighting problems. Prepared by Eastern Editor Berlon Cooper, it begins on page 81.

MULTIPLE TV OUTLETS

In the outlying areas where most new homes are built, a good outside TV aerial is often essential to satisfactory reception and in any case will provide better set performance. But already radio history is repeating with demands for more than one set in the home. Forward-looking builders have anticipated outlet requirements in a new project on Long Island, providing a high quality aerial and well engineered coaxial distribution circuits to convenient room outlets on part of the original wiring system. Installation is explained in "Now Home Wiring Includes TV" by Ira Kamen on page 99.

FLOOD RESTORATION

Out of the Kansas City flood restoration work, Middle West Editor August Eckel has selected the operations of Boese-Hilburn Electric Company as an informative case study on handling flood-damaged motors on an emergency schedule. "Drying 100 Motors a Day" is a picture story of the production line methods that were used. It begins on page 102.

DATES AHEAD

International Association of Electrical Inspectors—Southern Section, Hotel John Marshall, Richmond, Va., October 15-17.

National Electrical Contractors Association—Annual Convention, Shoreham Hotel, Washington, D. C., October 9-12.

International Association of Electrical Leagues—16th Annual conference, Roosevelt Hotel, New Orleans, La., October 10-13.

Electrical Manufacturers' Representatives of Virginia, Inc.—First Annual Electrical Industry Show, John Marshall Hotel, Richmond, Va., October 15-17.

American Institute of Electrical Engineers—Fall general meeting, Hotel Cleveland, Cleveland, Ohio, October 22-26.

National Electronics Conference—Edgewater Beach Hotel, Chicago, Ill., October 22-24.

National Electrical Manufacturers Association—Haddon Hall, Atlantic City, N. J., November 12-15.

Plant Maintenance Show—Convention Hall, Philadelphia, Pa., January 14-17, 1952.

America Institute of Electrical Engineers—Winter general meeting, Hotel Statler, New York, Jan. 21-25.

National Electrical Manufacturers Association—Edgewater Beach Hotel, Chicago, Ill., March 10-13.

National Industrial Service Association—Annual convention, Stevens Hotel, Chicago, Ill., April 20-23.

Chamber of Commerce—Annual meeting, Washington, D. C., April 28-30.

4th International Lighting Exposition and Conference—Cleveland Municipal Auditorium, Cleveland, Ohio, May 6-9.

National Association of Electrical Distributors—Annual convention, Atlantic City, N. J., June 9.

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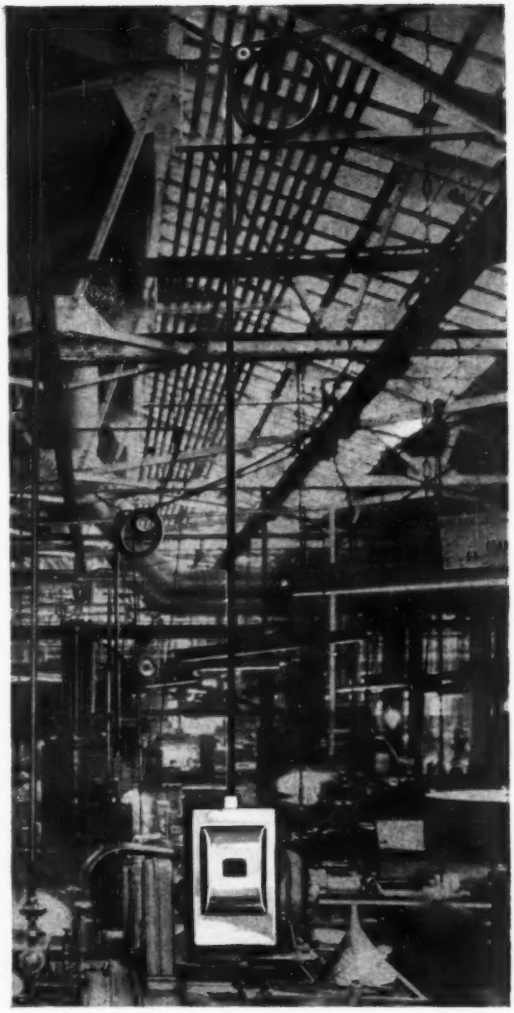

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

50th Year —OCTOBER • 1951

NECA's Fifty Years

TO THE OFFICERS, the staff and the members of the National Electrical Contractors Association go the hearty congratulations of all the electrical industry on the fiftieth anniversary of the Association. Founded in 1901 by a pioneer group in Buffalo, N. Y., NECA's golden jubilee convention this month meets in Washington in numbers sufficient to tax the convention resources of any of our greatest cities.

NECA TODAY bears little resemblance to its charter form. It now has thousands of members; full time staffs in headquarters and chapter offices; national recognition as a model of trade association practice; strong programs in education, promotion, research and labor relations; and ample resources.

SUCH PROGRESS wasn't made by just growing older. Each succeeding generation of officers and each new member has contributed a share to the growth and stature of the organization. Always there have been some with foresight, vision, and initiative who have led and goaded others forward to take on the greater tasks and responsibilities proper to the high destiny of the electrical contracting industry.

THE ANNIVERSARY will encourage talk of the old days; of the 16 c. p. lamps usually combined with a reliable gas jet; of fused rosettes and wood molding; of the great old house wiring projects on both sides of World War I which suddenly ended the gas light era; of dc to ac change overs; of the blossoming of light consciousness in the early 30s. Through such events we now see the electrical contractor in an expanding role, taking over larger markets and growing skillful with an ever more complex technology. At the time, even though he performed a great feat of creative engineering that revolutionized a nation's way of life, it was a rare contractor who recognized the tremendous social and economic significance of his efforts.

THE STRONG INFLUENCE OF NECA, its well planned promotional campaign, its active cooperation in all-industry affairs, are testimony to a growing recognition of the electrical contractor's key role not only in the electrical industry, but in the whole economy. And the years ahead, on any realistic projection, are years of growth—for the electrical industry—for the electrical contractor—for NECA.

WILL THE NEXT FIFTY YEARS record great changes resulting from the creative work of electrical contractors? They ought to. The pioneer spirit has changed little. The resources of vision, wisdom and skill in management and labor are greater than ever before. The opportunities already in plain sight are a challenge to the best efforts of all of us.

William T. Stuart

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Production Lighting Techniques

New reflector designs and improved visual environments, to provide better vision and greater seeing comfort, are current goals for industrial plants. These and other techniques for modern lighting application to speed production are explained in this article.

AMERICA'S HIGH PRODUCTIVITY is due to the high industrial standards of the thousands of well-lighted and efficiently-equipped factories, large and small.

GENERAL LIGHTING

GOOD lighting is of major importance in every industrial establishment. Its beneficial effects have been established and verified in extensive tests over many years. These include many benefits of vital importance in the present defense mobilization period: increased production, greater accuracy of workmanship, improved quality of product, improved employee morale, greater seeing ease, better work supervision, better housekeeping, and greater safety.

Current defense mobilization has pointed up one fact sharply: increased productivity is needed in both military and civilian production. And both types of production are urgently needed in the present semi-military economy. Better lighting can materially aid in providing increased productivity now. It is also a gilt-edge investment for the future peace economy for which this nation is heroically working and striving. Better industrial lighting *must* be installed in both new and old plants now producing both military and civilian goods, if the goal of increased productivity is to be fully realized.

Good industrial lighting consists mainly of general lighting for all production areas, and of supplementary or local lighting for specific seeing tasks where fine detail, inspection, sharp contrast, and similar factors are involved. Also, it consists of special application lighting for many industrial areas and processes, and of protective and emergency lighting, which are doubly important in the present emergency as safeguards against sabotage and in case of bombing attack.

General lighting is basic to all industrial areas. It involves the provision of a desirable quantity of light throughout an entire area, or room. The quantity of light which is desirable depends on the type of work being done in the area, or upon the severity of the visual tasks involved. In an area where the visual tasks vary greatly in severity, the area can be subdivided into smaller areas and each lighted with general lighting individually to meet the specific requirements. Or, in some cases, supplementary lighting can be used to implement the general lighting for the more severe tasks. In actual practice the usual solution is to select a good average base for the quantity of general lighting required, and to provide additional light for the severe visual tasks with supplementary or local lighting.

In planning the general lighting for an industrial plant, the problem resolves into the design of the general lighting for each individual area according to 1) visual requirements, 2) physical factors, presented by the building structure itself, 3) selection of the light source and luminaire, and 4) an appropriate arrangement, or layout, of the luminaires.

Visual Requirements

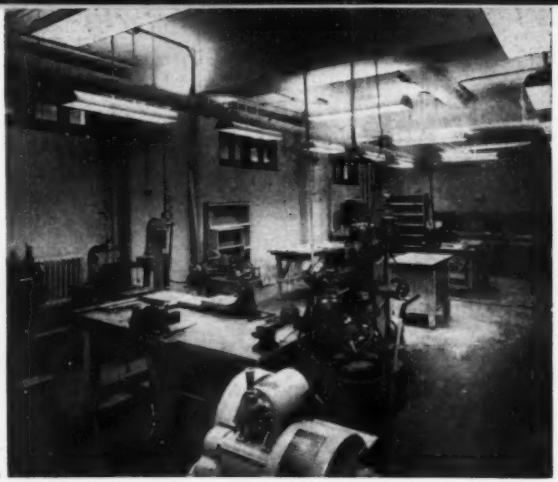
First step in planning a base for the general lighting intensity, which is the average footcandle level to be maintained in service, is to appraise the seeing tasks involved in the work to be done in the area. Recommended intensi-

TABLE I. Recommended Illumination Levels

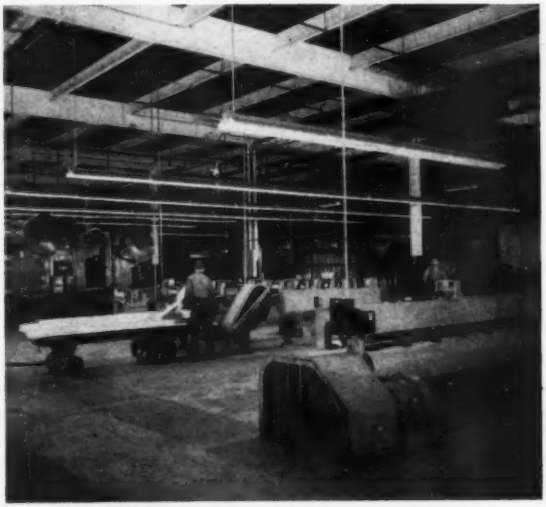
(In Footcandles Maintained in Service)*

SEEING TASK	TYPICAL EXAMPLES OF WORK	INTENSITY ON TASK
ROUGH	Inactive storage; corridors.	5 (3-10)
CASUAL	Active storage; service areas; stairways; aisles; washrooms.	10 (8-20)
ORDINARY	Moderately fine detail with normal contrasts — intermittent seeing. Automatic machine operations; rough grading; packing and shipping.	30 (20-40)
DIFFICULT	Prolonged work involving moderate contrasts. Ordinary assembly; bench work; machine shop operations.	50 (40-75)
VERY DIFFICULT	Precision work involving fine detail, fair contrasts, over long periods. Fine assembly; high-speed work.	100 (70-150)
EXTREMELY DIFFICULT	Precision work involving finest detail, poor contrasts, long periods of time. Extra-fine assembly; precision grinding; extra-fine finishing.	200 up

*Based on the Illuminating Engineering Society's 1951 American Recommended Practice of Industrial Lighting.



NEW STANDARDS for production lighting include upward light component and two-way shielding, as shown in these individual unit fluorescent reflectors in a machine shop.



OPEN END REFLECTORS each using two 40-watt fluorescent lamps are joined to form continuous rows of equipment and diffused comfortable lighting in a Baltimore steel plant.

General Lighting (continued)

ties for most industrial operations in the various specific industrial production fields, have been established by the Illuminating Engineering Society, and published in the IES "American Recommended Practice of Industrial Lighting." These intensities are here summarized in condensed form in "Table I—Recommended Illumination Levels" (above). Both general and supplementary lighting may be combined to provide the intensity on the task as recommended in Table I, provided limitations set by brightness ratios are maintained.

Lighting for seeing comfort is greatly influenced by the range of brightnesses within a given area. On a specific visual task, a brightness difference between the task detail and its background improves vision. On the other hand, a small variation in brightness of the surrounding area and the task permits the eyes to function most comfortably and efficiently. Thus the ideal brightness condition in a specific area with specific seeing tasks becomes a matter of proper balance of brightnesses within the range of vision. Shown in Table II are recommended brightness ratios considered acceptable in industry. These ratios are maximum, and any reduction in them should prove beneficial.

In order to control brightness ratios, the lighting engineer finds himself involved in not only the control of luminaire brightnesses, shielding against direct and reflected glare, and light distribution from individual units, but also in the reflectances of all surfaces within the area. He must also take into account the size, shape, color, and reflectance of the products being made. Table III gives a good guide for recommended reflectance values for room surfaces and for machine or furniture surfaces.

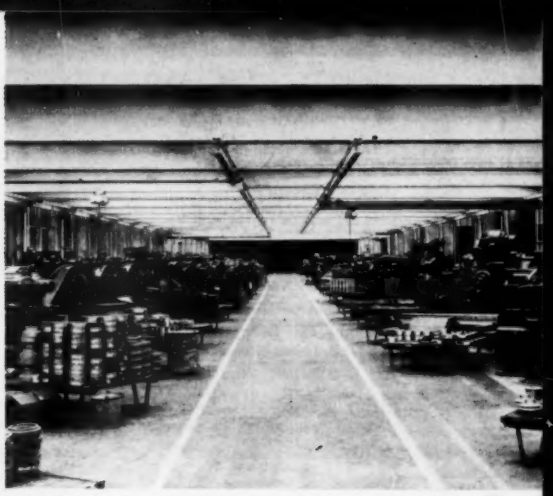
Finishes which are light in color and of flat or mat texture (non-gloss) are generally desirable. Such finishes improve the utilization of light by reflecting and diffusing it throughout the area. They are almost mandatory to provide proper brightness ratios within the area, and to maintain an efficient lighting system at the same time.

Structural Factors

The physical size and shape of a building structure influence the selection of the general lighting system. Physical factors have a bearing on light distribution requirements of the luminaires selected, also on maintenance provisions. Thus, indirectly these factors also influence the selection of the type of light sources to be used.

Most production areas may be classified as one of four types, according to size and shape: (1) low bay, (2) medium bay, (3) high narrow bay, and (4) high wide bay. These classifications relate to the ratio (Room

DIRECT-INDIRECT fluorescent reflectors provide good visual environment and 75 footcandle intensity in this paint-conditioned Attleboro, Mass. factory.



BEAM-SHIELDED continuous line reflectors provide ideal visual environment in a lathe and gear cutting shop, with low brightness lighted ceiling and high intensity lighting on work.

SLIMLINE LAMPS installed in 4-lamp continuous row reflectors are operated at 300 ma. to provide 80 footcandles, at 19-foot mounting height, 10-foot centers.

LUMINOUS REFLECTOR continuous row equipment, using plastic, lights the ceiling of this Cleveland plant softly, improves seeing conditions generally.

Index) of length and width of an area to the ceiling (or luminaire mounting) height of the same area. In general, however, the practical mounting height of the luminaires establishes the bay classifications for the various areas.

Light Sources

Three types of light sources are available today for industrial plant lighting, with a fourth on the horizon. These are fluorescent, mercury vapor, and incandescent —and under development, electroluminescent. Each type has its own advantages and disadvantages. It is up to the lighting engineer to select the type (or types) which best solve the many specific lighting problems which obtain in each industrial area when planning the general lighting for a plant.

Fluorescent—The fluorescent lamp is basically a diffuse-type of linear light source, since the diameter of the "line" of light is too large for accurate optical control. It is therefore ideal for use where diffused lighting is required, which is the case in most industrial general lighting applications.

Fluorescent lamps have long life, which reduces replacement and maintenance costs. Average life under normal operating conditions ranges from 7500 hours to 15,000 hours for various types of lamps.

These lamps are made in a range of spectral color designations, from yellowish warmtone to bluish-white daylight. The 3500°K and 4500°K white lamps are used principally in general production areas, while color-corrected

TABLE II. Recommended Brightness Ratios*

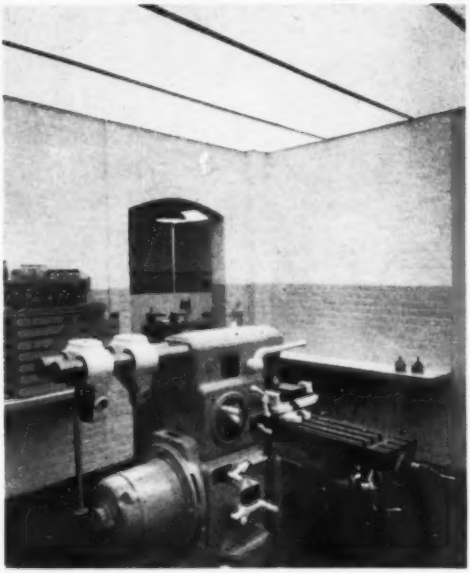
BRIGHTNESS BETWEEN	MAXIMUM RATIO
Tasks and adjacent surroundings	5 to 1
Tasks and more remote surfaces	20 to 1
Luminaires (or sky) and surfaces adjacent to them	40 to 1
Any two areas within the environment of the worker	50 to 1

*From I. E. S. American Recommended Practice of Industrial Lighting.

TABLE III. Recommended Reflectance Values*

SURFACES	REFLECTION FACTOR
Ceiling	80%
Walls	60%
Desk and bench tops	35%
Machines and equipment	25-30%
Floors (not less than)	15%

*From I. E. S. American Recommended Practice of Industrial Lighting.



LUMINOUS CEILING provides new standard of lighting quality in this machine shop. Intensity is 50 footcandles.

General Lighting (continued)

lamps are used where color discrimination is important.

Major disadvantage of fluorescent lamps is their low light output per lamp. Luminaires for these long tubular lamps are thus large and costly for the amount of light produced, even when several lamps are combined in the same unit. Use of the fluorescent light source thus automatically means high first cost for the lighting system.

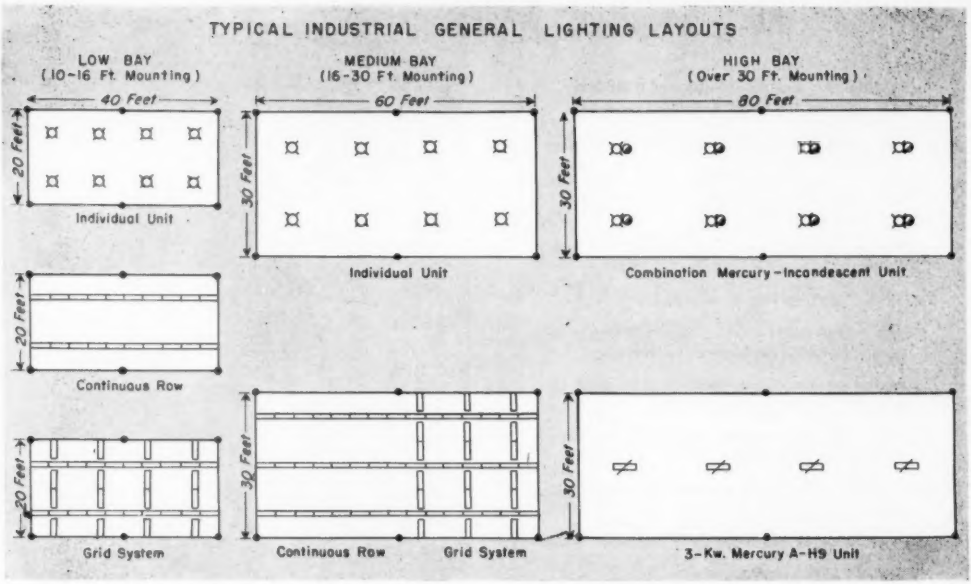
Mercury Vapor—The mercury vapor lamp is small enough in size to be considered as a point light source, except for one lamp which is a long tubular shape. Its light output can thereby be reasonably controlled by reflector equipment.

Three lamps comprise the mercury vapor industrial lighting line, although there are other sizes and types for special applications. The three lamps are: 400-watt Type E-H1—20,000 lumen; 1000-watt Type A-HI2—57,000 lumens; and 3000-watt Type A-H9, tubular—120,000 lumens. The 400-watt size is also made in Type J-H1, 18,000 lumens output, in which a phosphor coating is placed on the lamp bulb wall to add red light to the characteristic mercury vapor white light having a bluish-green tint.

Because of the high light output per lamp, and long rated lamp life, mercury vapor lamps are desirable for use in areas where luminaires are located at points difficult to reach for relamping and maintenance. For this

GRID LAYOUT of closed end individual unit reflectors installed in continuous rows provides diffusion and uniformity of light throughout entire production area in this plant.

OPEN TOP TROFFER suspended 2-ft. from ceiling provides efficient direct lighting with low brightness ceiling and 40 footcandles of illumination in this machine shop.



GENERAL LIGHTING LAYOUTS for industrial application should be based on type of work done in each area, type of light source best suited for light control and comfortable vision, size of bay areas and mounting heights.

reason they are often used in medium and high bay areas. Their spectral color quality is also excellent for metal-working plants, forges, foundries, and machine shops. They are often combined with incandescent lamps for color correction, and to provide a safety factor in case of momentary power interruption.

Incandescent—Incandescent lamps are used for general industrial lighting in sizes ranging from 200 watts to 1500 watts, and because of their low replacement cost and high light output per lamp, plus a large number of sizes to choose from, they still find considerable application in industry. Other sizes also find application in supplementary and special application lighting.

Industrial luminaires are selected according to their light distribution characteristics, lighting comfort factors, features of quality, high overall efficiency, and design features which simplify maintenance and relamping.

A recent trend in industrial lighting is to more lighting comfort, to a better quality of lighting. Various manu-features of quality, high overall efficiency, and design incorporate various features intended to provide better quality lighting, with greater seeing comfort. All of these features have merit. But few, if any, units have yet been made available containing all of the known improvements. The essential features of such a unit are listed in Table IV, which applies to a fluorescent luminaire.

HIGH BAY MERCURY lighting in this Pittsburgh foundry results in 24 footcandles from 3 Kw. Type A-H9 lamps, on 40-ft. by 50-ft. spacings, and 38-ft. mounting.

MEDIUM BAY MERCURY lighting is used in this automotive plant, with 1000-watt Type A-H12 lamps, and provides 70 footcandles.

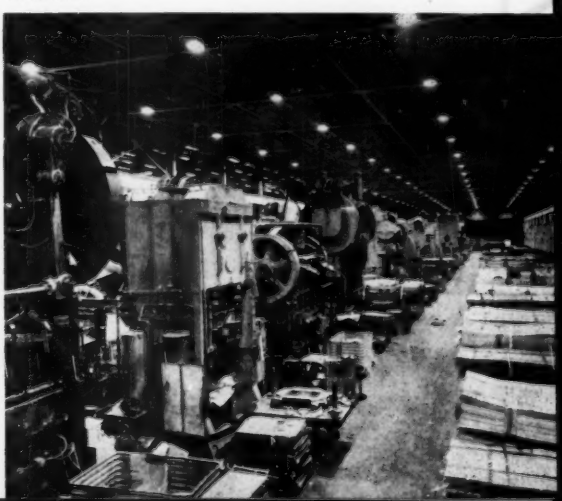


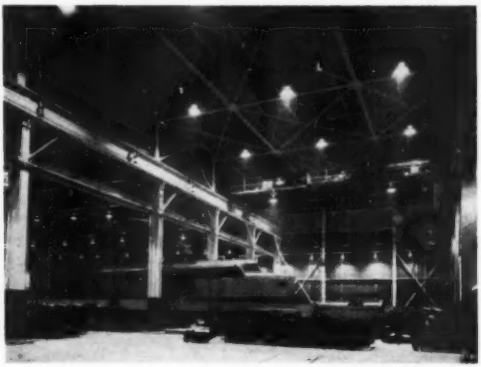
TABLE IV. Essential Features of a Modern Fluorescent Industrial Reflector Luminaire

1. Basic 2-lamp (or multiple) unit — for 2-lamp ballast operation.
2. Direct glare shielding — for 30° to 45° shielding both laterally and longitudinally.
3. Semi-direct light distribution — with 15% to 30% upward component.
4. Efficient — 65% to 75% overall light output.
5. Light finished exterior — 30% or higher reflectance on all exterior surfaces, or low-brightness luminous sides.
6. Durable reflecting surfaces — white porcelain, baked enamel, Alzak aluminum, glass, plastic, etc.
7. Easily maintained — removable louvers, with easy access to lamps and starter switches.
8. Well ventilated — to permit operation of lamps and ballasts at design temperatures, and provide self-cleaning action.

HIGH NARROW BAY is lighted to 35 footcandles by alternate 400-watt mercury and 1000-watt incandescent reflector units, installed 80 feet from floor.

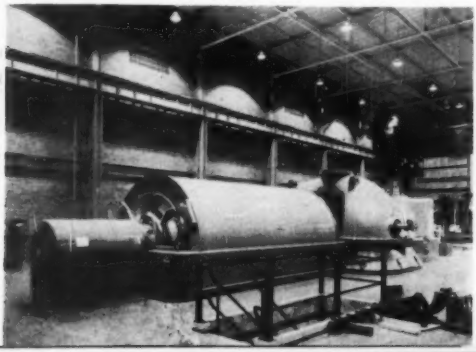
General Lighting (continued)

LOW BAY MERCURY lighting is used in this New Jersey plant. Lamps are 400-watt Type A-H2, and are used in aluminum reflectors.

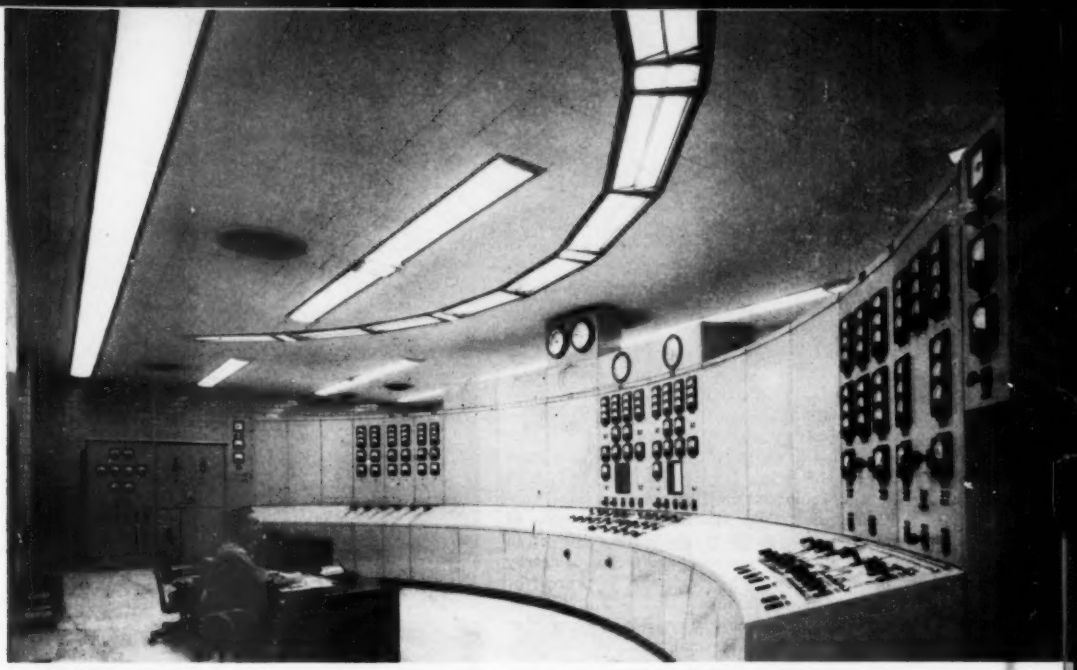


HIGH BAY prismatic glass reflectors are spaced on 18-ft. by 24-ft. centers, installed 42 feet from floor, and equipped with 1000-watt incandescent lamps in this installation.

HIGH BAY reflectors using 1500-watt incandescent lamps light this power plant turbine room. Spacing is 22-ft. by 25-ft., mounting height—44 ft. High reflectance surfaces.



TWIN-REFLECTOR medium bay dustproof units, using one 400-watt A-HI mercury lamp and one 500-watt incandescent lamp, provides 30 footcandles in this large plant.



DIRECTIONAL CONTROL of light is obtained by prismatic glass lenses in this electric utility control room. Vertical illumination required on boards averages over 30 footcandles. General lighting averages 60 footcandles. Brightness ratios are good.

SPECIAL APPLICATION LIGHTING

GENERAL lighting is basic to the average production area. It is provided by standard luminaires and light sources, installed in accordance with some standard layout. Typical general lighting layouts are shown in the drawings at top of page 85.

There are many production operations, machines, and industrial processes for which general lighting is not entirely satisfactory. These may require special directional light control, special location of luminaires, special types of lighting equipment to provide special light distribution, or special spectral quality of illumination. Solution of the lighting problem for these special conditions, whether by standard or special types of luminaires and equipment, is usually referred to as "special application" lighting. It differs from supplementary lighting (pages 95-96) in that it may, and quite often does, constitute the entire lighting for an area. Generally, supplementary lighting is used to provide PLUS lighting, supplementing the general (or special application) lighting system. Inspection lighting is normally considered as special application lighting, although it is here presented separately (pages 91-94) for the purpose of grouping inspection lighting techniques together and for further pointing up its importance in production.

Special application lighting principles as they apply in industry cover practically the whole field of lighting techniques. They are limited only by the ingenuity of lighting and industrial engineers who apply them to the lighting problems encountered. Several of the more important applications are illustrated here to indicate prin-

CONTINUOUS 2-LAMP cold cathode reflector unit is angled to flood 485-foot long conveyor belt assembly line with diffused comfortable light in a large electronic plant.

ciples which are in common use today, and to provide a roundup of these principles for the benefit of those lighting men and engineers responsible for lighting the nation's productive facilities for full defense mobilization. Some of these techniques and principles are treated separately in the following paragraphs.

Directional control—The large number of sizes and shapes of machines used in production, and even of products themselves, present a problem of getting light to working areas of the proper intensity and quality. Also, many seeing tasks in industry require high levels of vertical illumination, such as the lighting of instrument or control panels and boards.

In order to solve such problems, it is necessary to provide a lighting system which will direct light to the work areas or instruments where the visual tasks exist. To do this, the lighting equipment must provide directional control. It must project light into hard-to-reach areas of machines and equipment. It must confine the light in some instances, to prevent glare in the direction of nearby workers, or diffuse it in other instances, to prevent or reduce sharp and harsh shadows.

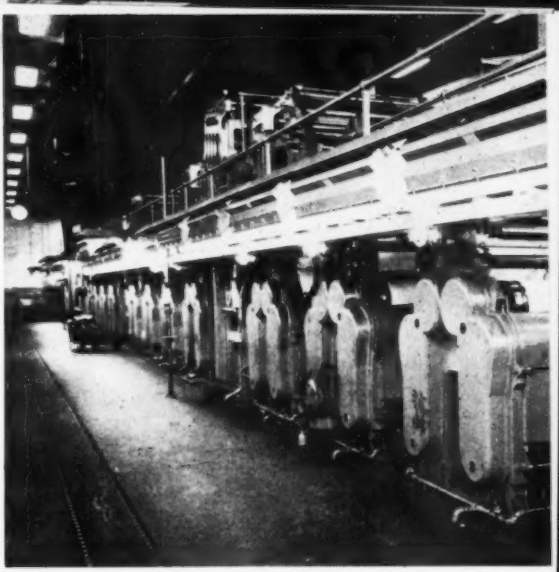
Directional light control can be provided in a number of ways. Standard units with symmetrical light distribution can be tilted to the desired angle, or units with asymmetric light distribution, such as angle reflectors, can be installed in their normal position, to provide the directional control needed. Prismatic glass lenses with lamps properly positioned for the desired light distribution can also be used. And projectors, or reflector spot and flood lamps can be mounted at the required location and angled to project the light where needed.

Special location of units—Standard or special units can be installed at special locations to provide the required quantity and quality of light for a specific seeing task. A typical example is the lighting of a pressmen's platform in a printing plant. Another example is the lighting of a continuous line assembly bench by installing a continuous row of fluorescent reflector units above the workers and behind them at a proper position so that the employees do not cast their own shadow on the work. This technique provides diffused light over the entire assembly area and prevents direct or reflected glare in the direction of the workers' eyes. In most applications of special application lighting, the location of the lighting equipment is of paramount importance.

Hazardous areas—Some industrial areas contain inflammable gases or vapors, combustible dust, or other atmospheric conditions which create an explosion hazard for the usual types of lighting units. Specially built explosion-proof luminaires are required for lighting these areas. Dusttight and vaportight units are also available for less hazardous areas where danger of explosion is very remote. Installations in all such cases must conform to the provisions of the National Electrical Code covering construction and installation details of the luminaires.

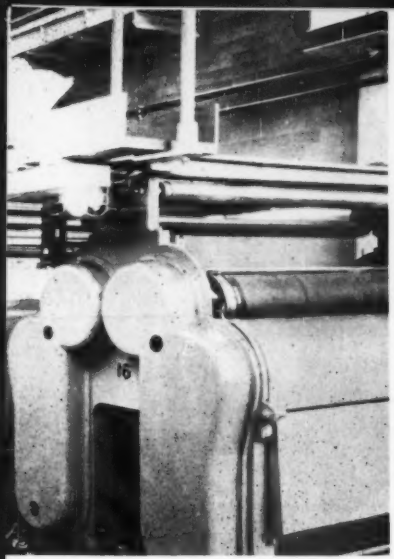
A paint spray booth is a typical example of a hazardous location. It can be lighted with standard symmetrical distribution incandescent or fluorescent explosion-proof luminaires installed above the work area, or located at each side of the booth and angled to direct the light to the center of the booth. It can also be lighted with standard industrial reflectors installed outside the booth walls, located behind gasketed "windows" of explosion-proof glass. Most explosion-proof luminaires are designed to withstand internal explosions without breakage of the unit. But some units are made explosion-proof by pumping compressed air into the units which are provided with air leakage. Such units must also be equipped with safety switches which will disconnect the power supply to the unit when the air pressure drops.

Black ray lighting—Use of black light, or the radiation of fluorescent-treated products with invisible ultraviolet, which causes the fluorescent materials to become visible in darkened areas, has many industrial applications, both in production and inspection. Use of this technique satisfactorily solves in a practical way many



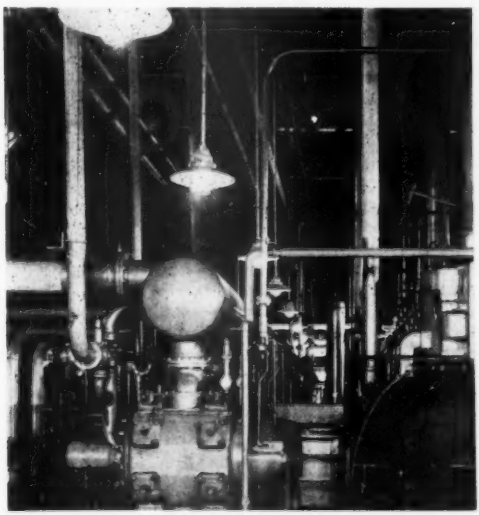
VERTICAL SURFACE lighting is provided on this pressmen's platform by angled dust-tight fluorescent units. Intensity

REFLECTOR LAMPS project light inside trucks at loading platforms, and serve as floodlights for many close range floodlighting applications.



averages 80 footcandles, ink spray is easily removed from covers by wiping.

POLE MOUNTED FLOODLIGHTS provide outdoor area lighting for storage and dock areas, shipping platforms, and other similar operations.



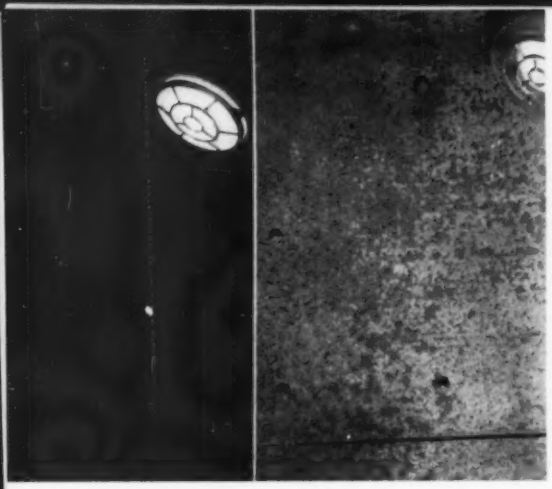
EXPLOSION-PROOF INCANDESCENT UNITS are used in the compressor room of a major oil refinery. This type equipment is required for all hazardous areas by the N.E. code.

TWO WAY LOUVERS shield lamps in reflectors over work benches of a shoe factory, to improve lighting quality and prevent eyestrain. General lighting is also needed here.

seeing problems which are most difficult, and in some cases impossible of solution with the use of normal light.

Color lighting problems—Many color lighting problems exist in industry. First, there is the problem of color matching, in which it has been found that no one light source, including daylight, is entirely satisfactory. Next, there is the problem of color discrimination, or the detection of color differences. This is important in maintaining color standards, as for example in producing blue cloth for Navy uniforms, or in maintaining purity of some drugs or chemicals which show variations in color with variations in purity. These problems are most critical in color printing, paint and dye manufacture, chemical production, and textile and fabric industries. But they also exist in many other fields of industry.

While the subject of "color in lighting" is too complex to be summarized briefly, some generalizations are considered appropriate. Where color problems exist, and materials or products must be lighter for appraisal, it is recommended that room surfaces be finished in neutral tones where the appraisals are to be made. This will eliminate the problem of color distortion and dilution caused by light being reflected from the walls, ceiling and furniture. For color matching, illumination levels of 200 to 400 footcandles should be provided. Light sources used should provide a continuous spectrum throughout the



SPECIAL EXPLOSION-PROOF UNITS are installed in ceiling of an explosive test building. Units were designed with protection against flying particles during tests.

BLACK LIGHT (ultraviolet) radiation is used to activate a fluorescent powder applied to cloth so that an embroidery pattern may be followed easily.

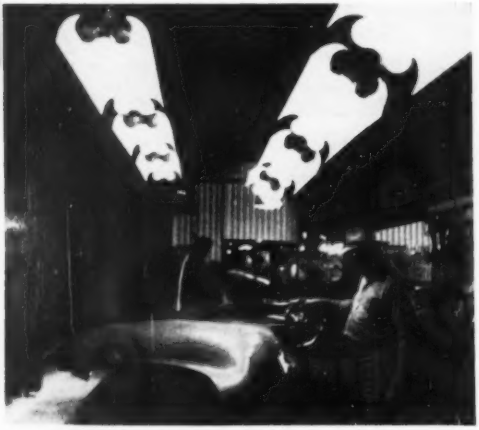
Special Application Lighting (continued)

visible range. The new "de luxe cool white" fluorescent lamps, or proper mixtures of a number of other light sources will provide this spectral quality. Any system selected should be standardized, and all factors noted for purposes of duplication.

Special color matching or examining booths, or entire rooms where the problem will justify the cost, can be constructed for color lighting work. Such areas can be used for grading of products (tobacco, cotton, etc.), for color matching, for inspection of color printing proofs, and similar production work.

To see all colors of materials, the light source must produce all colors of light. Further, the employees' eyes must respond to all colors. This is important in production, for example, where color coding is used in connection with a product. An example would be a radar set where the wires are traced and identified through colors.

Miscellaneous applications—Inspection lighting is considered special application lighting. Other examples include the lighting of pits, stock bins, shears, assembly benches, composing stones, etc. Pit lighting is done with asymmetric light distribution units recessed in the walls of the work pit, to project light to the underside of railway cars, busses, autos, etc. Stock bins are lighted with special asymmetric type reflectors or continuous row fluorescent lamp units. Shears are lighted with projector lamps or fluorescent lamps mounted over the shears at an exact point so that the shadow line from the light source coincides with the cutting line of the shear blade. Large area panel lights installed at approximate eye level are effective over assembly benches, composing stones, and similar seeing tasks.



EXPLOSION-PROOF FLUORESCENT UNITS provide good diffused illumination in a typical paint spray booth. Similar equipment is required in all hazardous areas.

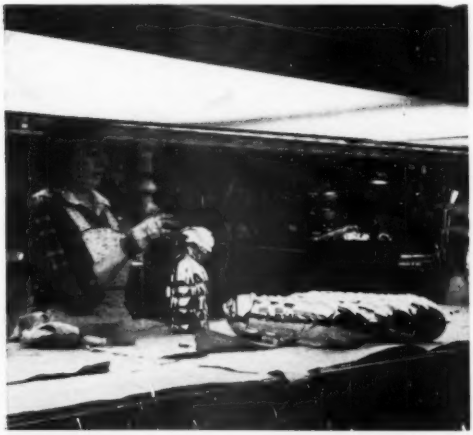
STRONG FOCAL LIGHT in a binocular ophthalmoscope makes possible examination and high magnification which aids in eye care and treatment.

CLOTH INSPECTION by high intensity direct lighting on material is provided in this Southern textile plant by banks of three 3/40-watt industrial reflectors installed at angle over each inspection station. Intensity is over 100 footcandles.

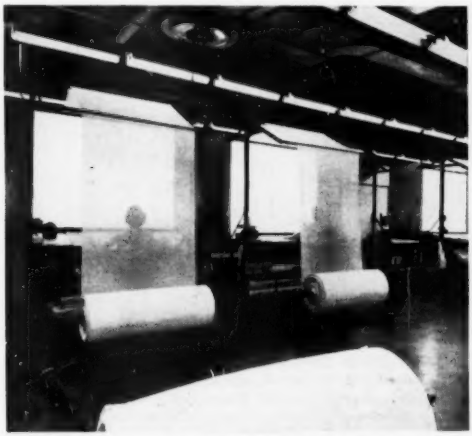
INSPECTION LIGHTING

ONE of the most important phases of lighting in any production area is that of providing the best light possible for inspection of the finished product. This is especially true in the manufacture of war material, as the course of a military engagement, and even the lives of military personnel, may depend upon the quality and perfection of the military items in use. Poor inspection could prove most costly in such cases. In the case of civilian products, poor inspection could also lead to the curtailment of business for a manufacturer, or to his eventual failure.

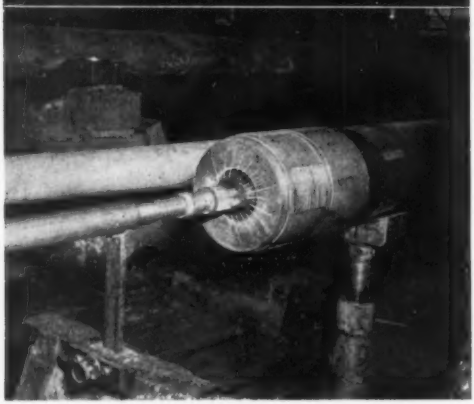
Different types of products require different types of lighting for good inspection. This accounts for the many types of inspection lighting now in use. Here again the



LARGE PANEL LIGHT with uniform low brightness aids inspection of polished surfaces, such as chrome plating, by reflection of the light source in the metal surface.



DAYLIGHT FLUORESCENT LAMPS behind glass panel (24—40-watt lamps per unit) create luminous background for cloth inspection by transillumination.



INSPECTION OF GUN BARRELS has been solved through development of Boresearcher equipment shown here, designed, made, and used in the U. S. Naval Gun Factory. In photo at top a Boresearcher with one bulb and reflecting mirror is pushed into gun barrel as inspector uses telescope to check for cracks or flaws. Close-up of light and mirror are shown in center photo. Large Borescope using two tubular lamps (bottom photo) is also used for optical inspection of gun barrels of large bore.

EDGE LIGHTING reveals interior and surface defects in transparent materials such as clear plastic, when viewed against a dark background. A 15-watt fluorescent lamp provides light through a slot opening in its housing.

Inspection Lighting (continued)

lighting industry is called on to make full use of its storehouse of lighting knowledge, and in some cases full use of principles of light optics, to best solve the many problems of inspection lighting encountered. Inspection of gun barrels, for example, requires the use of light projection and control, and of optical assemblies to permit reflection and magnification of all area surfaces within the barrel.

Both the quantity and the quality of light is important in most inspection lighting. The intensity should be adequate to permit the degree of critical inspection required, and to permit speed of inspection to save man-hours and costs. The quality of the light is equally important, and varies with the material, size, color, surface texture and similar factors of the products being inspected.

The visual tasks involved in inspection vary greatly. But these can be classified into a relatively few types, from a lighting standpoint. First, all visual tasks can be classified as the viewing of flat surfaces, or of three-

COLOR MATCHING requires at least two spectral qualities of light, and high intensity. Unit shown contains mixture of incandescent and fluorescent, produces 200 footcandles.

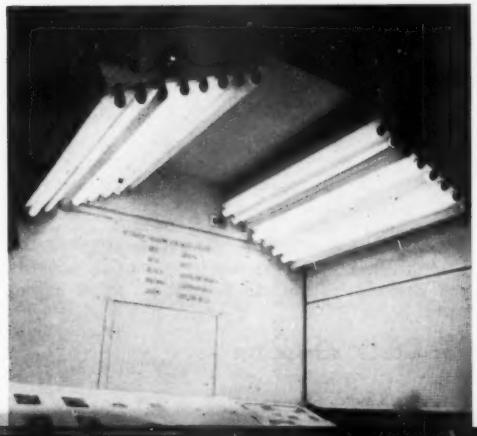
CONCENTRATED LIGHT directed at a grazing angle toward large flat surfaces reveals defects and surface imperfections. Reflector spot lamps are shown in use here. Flaws, pit marks, scratches, etc., show up as shadows.

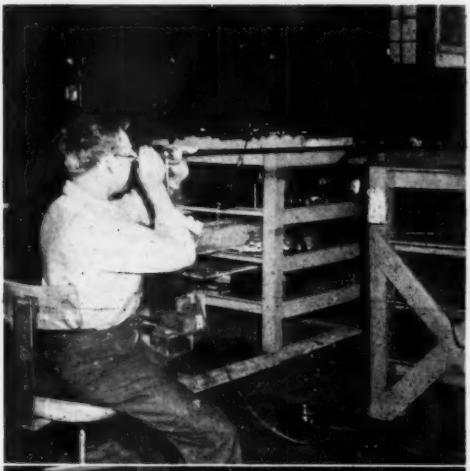
dimensional objects. Then, flat surfaces may be classified further as opaque, translucent, transparent, or transparent-over-opaque. Likewise, three-dimensional objects may be classified further as opaque, translucent, or transparent. Each of these sub-classifications may also be further defined and subdivided, to provide well defined specific seeing tasks for which satisfactory lighting solutions become readily apparent.

Inspection lighting techniques now used to solve many seeing task problems include direct lighting of opaque and transparent materials and products, trans-illumination of translucent materials, projection and magnification of images of very small items, treatment of surfaces with fluorescent materials for viewing under ultraviolet (black light) radiation, use of polarized light, and others. Examples of some of these are shown in the accompanying illustrations.

Large area light panels offer an excellent solution for lighting most objects for inspection where specular surfaces are involved, also for the trans-illumination of many

INSPECTION OF COLOR proofs for four-color printing is made easy by using four groups of fluorescent lamps of different colors, controlled separately by color.





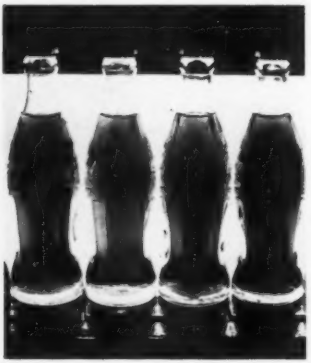
SMALL LIGHT AND MIRROR (top) is used at tip of 20 mm. Borescope to light inside of small barrels and reflect back through lens optical system to inspector. Center photo shows chamber Borescope used strictly in gun barrel chamber to check the base of the rifling. The series of lenses in the long eye-piece gives a 4-to-1 magnification. The small battery-operated Auglite (bottom) is used mainly in rifling or chambering operations. The longest bar is flexible lucite for bending light around corners.

LUMINOUS PANEL in a table top provides light source for inspection of parachute seams by means of transillumination. Fluorescent lamps light panel.

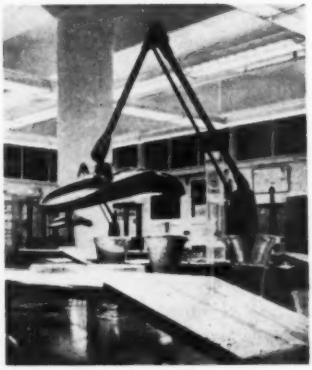
BLACK LIGHT can be used for inspection of metal parts by treating parts with oil containing metal filings treated to fluoresce when irradiated by black light only.

PROJECTION of images by light optical assemblies on white screen permits large magnification of small detail, and thereby more critical inspection.

TRANSPARENT OBJECTS of all types can be inspected against easily-constructed luminous areas. Brightness of the luminous panels should be uniform.



LUMINOUS BACKGROUND provides light for inspection of bottled liquids. Magnifying lens can be added where critical examination is essential.



ADJUSTABLE BRACKET LIGHT with magnification lens attached contains two 6-watt fluorescent lamps and is used to inspect seed. Intensity is 300 ftc.

POLARIZED LIGHT can be adapted for inspection of some transparent materials, such as the vinyl laminate for safety glass shown here. Stains show up as brightness differences, and stresses and strains are readily visible.

Inspection Lighting (continued)

transparent or translucent objects and materials. Fluorescent lamps concealed behind diffusing panels of glass, plastic, cloth, or paper provide good diffusion of the light, and a uniformly bright panel. Electroluminescent panels (the new "area" light source) will probably find wide application in this field.

Where color is a factor in inspection lighting, satisfactory spectral quality artificial light can be provided. Two methods are used for producing a desirable spectral quality —the subtractive method with filters, and the positive method with grouping of different spectral quality light sources to provide the desired final spectral quality needed for inspection of a specific product.

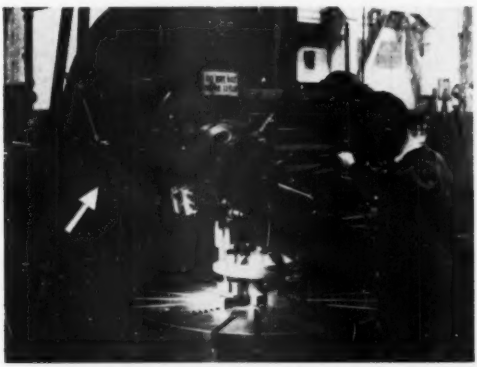
Directional light projected at an oblique angle has been found useful in revealing surface flaws, irregularities in surface shape, pit marks, scratches, and cracks in nonspecular or mat materials. Polarized light can be used to detect internal strains in translucent materials, and stroboscopic light can be used to inspect moving parts.

SUPPLEMENTARY LIGHTING

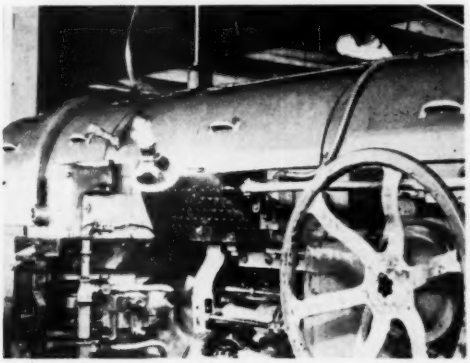
SUPPLEMENTARY lighting is used principally as an economic solution for providing a high intensity of quality lighting over a relatively small work area where the desired intensity level cannot be justified throughout the entire area in the form of general lighting. Also, supplemenary lighting offers directional control and three-dimensional highlights and shadows which are desirable for many industrial seeing tasks, and permits the elimination of shadows which might be caused by workmen from general overhead lighting. Supplementary lighting "supplements" a general or special application lighting system and improves seeing conditions with respect to a specific visual task. In many cases it might also be classed as a special lighting application.

Several types of supplementary lighting devices and equipment are available. These may be classified as directional (concentrated distribution), diffuse (spread distribution), and special purpose (luminous panels, edge lighting, etc.). Supplementary lighting units are made both for portable, and for fixed or fixed-adjustable use.

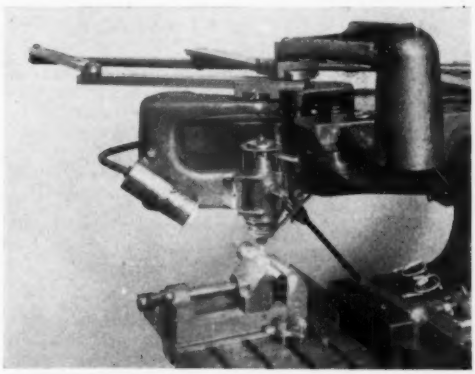
SUPPLEMENTARY LIGHT is provided for electronics workers in this plant by adjustable 2/15-watt fluorescent lamp brackets, adding 100 footcandles to the general lighting.



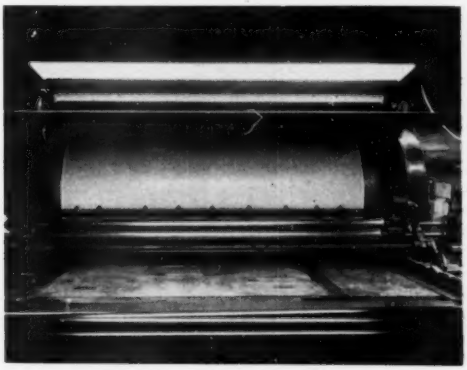
REFLECTOR LAMP housed in ventilated can at left (arrow) produces 300 footcandles at visual task area on this vertical turret lathe. Concentric louver shields the 150-watt PAR-38 lamp from operator's view.



PAR-LAMPS on double-arm adjustable bracket fittings floodlight this multi-spindle automatic machine, can be swiveled to proper angle for best lighting result. They provide high intensity light over a small area economically.



AIRCRAFT READING LAMP, shown with glare cover removed, has been adopted by a large electronics manufacturer as a supplementary lighting unit on engraving machines. High intensity helps operator judge depth of cut in engraving.



TWO SINGLE LAMP 40-watt fluorescent reflectors effectively light under the feed board of a flatbed press, supplementing the general lighting. One reflector is tilted slightly toward the roll, to direct light to the area where needed.

PORTABLE LIGHT units are useful for many seeing tasks. Here (bottom) is a 15-watt fluorescent lamp unit protected by plastic cover which is attached to a hydraulic jack, and (top) a 150-watt PAR-38 lamp with guard on a castor base.

Supplementary Lighting (continued)

Portable units are desirable where the need for supplementary light is intermittent, as in airplane assembly, garages, and repair shops where internal surfaces must be viewed. Permanently mounted units are preferable where the need for supplementary light is constant, as on machines, over work benches, etc. Adjustable arms and swivels can be used where flexibility in direction and control is important.

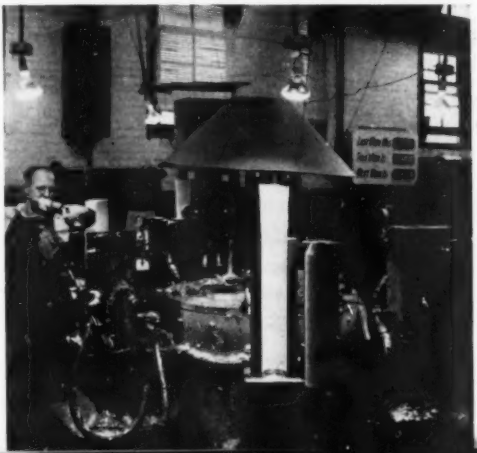
Industrial lighting was originally based on use of local area lighting almost exclusively. Only in recent years has the principle of high level general lighting been developed and generally accepted. In many industrial areas high levels of general lighting (75 to 100 footcandles) can be justified and are adequate for most seeing tasks. But in most industrial plants there exist many seeing problems which can be improved very materially through the use of supplementary lighting—in fact, some seeing tasks can only be lighted adequately and satisfactorily with some type of supplementary lighting device. Each seeing task should be individually appraised and individually solved for best lighting results.

Supplementary lighting units of all types should be adequately shielded and louvered, and properly mounted so that no glare exists either for the workmen whose seeing tasks are being illuminated, or for workmen at other locations in the same area. Supplementary lighting intensities on the work should not exceed five times the general illumination, as a general rule.

PINHOLE SPOTLIGHT throws tiny dot of bright light on tip of copper electrode where weld will be made.

A LIGHTING HOOD provides 120 footcandles for this stereotype router. Inside the hood are three 20-watt fluorescent lamps, and entire interior of hood is painted white.

FOUR 300-WATT R-40 lamps provide 1000 footcandles at the pouring point of this stereotype mould, and 150 footcandles on the vertical surface of the pattern plate.



LIGHTING OF BOUNDARIES and property lines is used as effective method of plant protection against saboteurs and undetected entry of non-authorized persons. Street lighting luminaires are used in this installation.

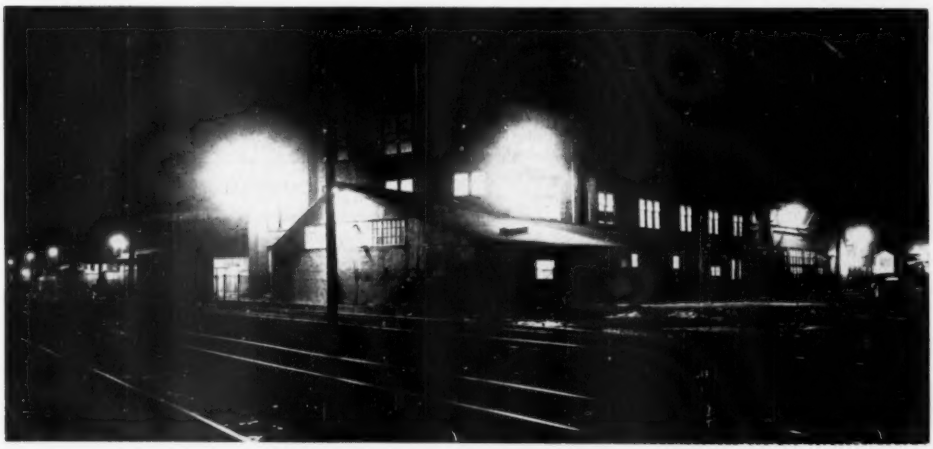
PROTECTIVE LIGHTING

MAJOR objective of defense mobilization planners today is increased productivity. Likewise, first objective of saboteurs is to cripple production. For saboteurs to promote their objective, they need to enter plants, and power and community properties in order to do their greatest damage.

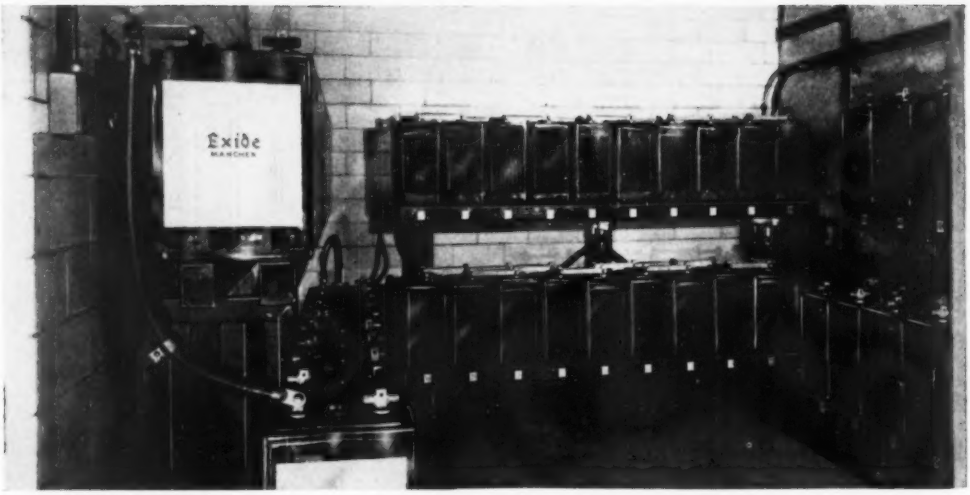
Protective lighting is a form of insurance against the work of saboteurs, or thieves. It can aid the guards of industrial and public properties in detecting illegal entry, and to hinder such attempts by unauthorized persons.

Protective lighting is needed both outside and within industrial plants. Exterior lighting is needed to aid watchmen in properly guarding property lines and boundaries during hours of darkness, and interior lighting is needed to aid guards in detection of unauthorized persons who may have gained access to a plant's interior.

The method of lighting for protection depends on the physical layout of an individual plant, the location of watchmen and guards, most likely means of approach, and similar factors. Usual technique is to provide a "glare barrage" along boundaries, or in a direction away from buildings, to illuminate an area along boundaries ample to detect moving persons, and to provide illumination along all interior roadways, in areas between buildings, around vital structures, etc., to permit guards to see all activities clearly within the plant property. Streetlighting luminaires, floodlights, fresnel lens units, etc., are generally used for these purposes.



GLARE directed away from industrial building hinders would-be intruders, lights approaches around plant to aid guards in detection of attempted entry. Floodlights and fresnel lens units are effective for this purpose.



STORAGE BATTERIES or motor generator sets usually supply standby power in case of normal power failure.

EMERGENCY LIGHTING

INDUSTRIAL plants need emergency lighting for the safety and security of their employees. It is a guarantee against plunging an entire plant into total darkness in case of failure of the normal electrical supply, which sometimes starts a series of events that may prove disastrous.

Emergency lighting is needed principally in the danger zones of an industrial plant, and to provide safe egress from the plant in case of power failure. The danger zones can be segregated easily, and would include the engine and boiler rooms, transformer vaults, entrances and exits, boundary fences, and any production areas where continuation of a process is vital.

An emergency lighting system consists essentially of a standby power system, separate wiring circuits, and suitable lighting units. The prime requisites of such a system are *instantaneous action and reliability*. When the normal source of power fails, the emergency circuits must be instantly energized, automatically.

Standby power can be provided by a separate motor-generator set, storage batteries, or duplicate service from the power company. The standby power supply must be entirely independent of the normal power supply, but should be so connected to it that the emergency system will operate automatically and instantly upon failure of the incoming electric service.

Many types of emergency lighting equipment are available. Standard widespread luminaires can be installed on emergency circuit outlets. Many standard exit signs are equipped for both standard and emergency circuit operation. And there are now available self-contained battery-and-projector lamp units, complete with extension cord, pilot light, and transfer switch. These can be located in any area where needed, and need be merely plugged into the regular power supply circuits. Phosphorescent plastic signs, which operate independently of any power source, are also available. These signs store up energy from visible light radiation, and continue to glow after the lighting system has been turned off.

DUAL-PURPOSE EXIT light operates on normal lighting circuit, automatically changes to self-contained battery circuit in case of power failure. Unit contains sign, also throws beam of light downward to light exit passageway.

ACKNOWLEDGMENT

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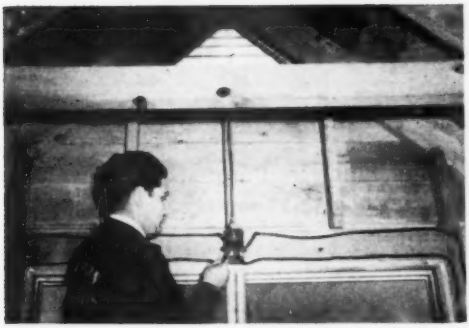
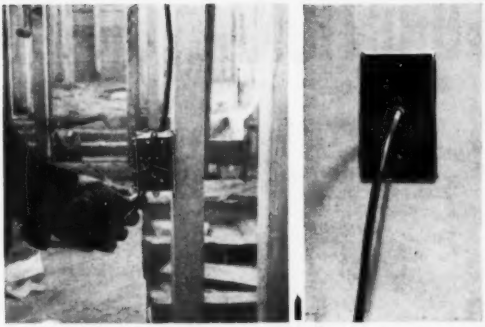


COAXIAL CIRCUITS are installed by the electrical contractor at the same time he installs wiring for power and lighting in the home. Simple installation techniques are applicable.



TELEVISION COUPLER, located inside the home, divides antenna signal into four equal parts. Jacks establish connections with the antenna lead-in and coaxial circuits.

Now Home Wiring Includes TV

Electrical specifications cover installation of television antenna, signal-dividing coupler, shielded coaxial branch circuits and multiple outlets.

By Ira Kamen

Director of Electronics, Brach Manufacturing Corp., Division of General Bronze Corp., Newark, N. J.

THE installation of television antennas and simple coaxial distribution systems to serve multiple TV outlets in private dwellings is a potentially vast new source of added business for electrical contractors throughout the country. Already this service is being incorporated in wiring specifications of some large residential housing projects where provisions for TV reception are becoming standard services.

One of the first cities to witness the extensive adoption of this potential market is Garden City, Long Island, New York, where homes designed by architect Dominick Salvati and built by Martin Moss are being wired for multiple television reception by the Television Utilities Corporation.

By installing TV reception and distribution systems at the same time the wiring for power and lighting is installed, wires can be carried inside walls or partitions and TV outlet boxes neatly located adjacent to standard appliance receptacles. Makeshift arrangements for mounting antennas can be eliminated, and unsightly lead-in wires are no longer visible.

In a typical Moss-built home there are four TV outlets, located in the living room, two bedrooms and basement rumpus room. This makes it possible for the home owner to place his television set in any of these four locations by merely inserting two plugs behind his set; one for power, the other for antenna signals. In addition, since the coaxial cable to each of the four outlets is shielded against interference, several TV sets can be installed and operated simultaneously to receive programs on different channels.

In some of our large metropolitan areas where up to seven channels are now in operation, this multiple-outlet provision is a strong sales-promotion point, for present reduced prices of TV sets makes it feasible for a home owner to have more than a single unit, and the varied tastes of family members—for sports, music, comedy, drama and/or news—make multiple reception almost a "must" for family harmony.

The main item of equipment, aside from the antenna, is a distribution unit about four times larger than a pack of cigarettes. This unit divides the antenna signal into four equal parts for distribution to the four TV outlets. Units installed at Garden City are Brach Mul-Tel 4-set couplers, having a pair of jacks at the top to receive the 300 ohm polyethylene transmission line from the antenna, and four bottom jacks to serve the RG 59/U coaxial circuits extending to the outlets. Since these coaxial lines carry no current potential greater than about half a volt, Fire Underwriters' regulations are amply complied with. TV outlet boxes are single-gang units, complete with male and female coaxial fittings and attachment plugs.

Since Garden City reception is relatively weak, sturdy stacked conical antenna arrays are specified. Antennas are mounted on either aluminum or steel masts, using non hydroscopic insulators. Masts, in turn, are generally mounted on chimneys, while ribbon lead-in cables are carried under the roof eaves and into attics where they are connected to the coupler unit. Antennas can be erected with considerable speed, for all components are hinged in position and the installing crew only has to open the assembly, tighten several thumbnuts, and mount the array.

It is of economic interest to note that the wholesale value of a typical antenna, mast, transmission line, distribution unit, coaxial cable and TV outlet plates is between $20 and $25, permitting a liberal margin for labor and overhead, while maintaining a reasonable installation cost to home owner.

With pre-assembled parts to install, and no vacuum tubes at any point in the distribution system, installation techniques are not complicated, knowledge of electronics is not required, and maintenance is eliminated.

FUNCTIONAL ORGANIZATION—An Asset

Can you improve your management operation? Here's an approach to more efficient business control through functional organization.

By Ralph E. Johnson
Vice President and General Manager
Sturgeon Electric Company, Inc., Denver, Colorado

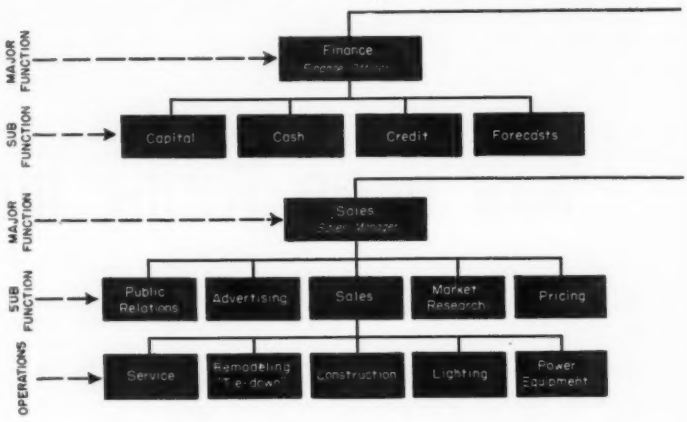
RAPID increases in the use of electrical energy and equipment over the past decades have paced the steady growth of the electrical industry in general. Paralleling this growth has been the steady rise of the electrical contractor as a business man—a gradual transition from one-man operation to an established company or firm with numerous employees. Much of the electrical contractor's success in his field has been due to his ability to manage his operation efficiently.

As any firm or company increases in size, its management organization becomes more complex from the standpoint of operating functions and personnel responsibilities. Whether such responsibilities are vested in a single person, or in a group of individuals depends upon the organizational setup. Regardless of the number of men in the managerial bracket, the functions necessary to operate the business still exist. The main difference is that in the former, where the business may have "grown up" around one or two men, these persons perform multiple functions and lines of responsibility may be less clearly defined than in the latter where several members of a management team perform individual clearly defined duties.

When the management framework has been "built" around the functions necessary to operate the business, it is generally termed "functional organization." As implied, it is a method of building an organization by grouping related operations as component parts of a clearly defined major business function. Under this scheme, when one or more members of the management team retire or leave the firm, the frame work remains intact and the specific duties of successors are clearly defined.

A functionally organized company is developed or "built" from the bottom up; consists of the following prime elements:

Operations—the smallest integral parts of the business as a whole.



Sub-Functions—the logical grouping of certain operations to be done by one person or a group of persons having a common ability.

Major Functions—the responsibility for coordinating and directing the component operations as grouped by their relationship to each other and to the overall problem of which they are a part.

General Management—the top of the management framework which coordinates the major functions and directs them in an effort to achieve the main business objective-profit.

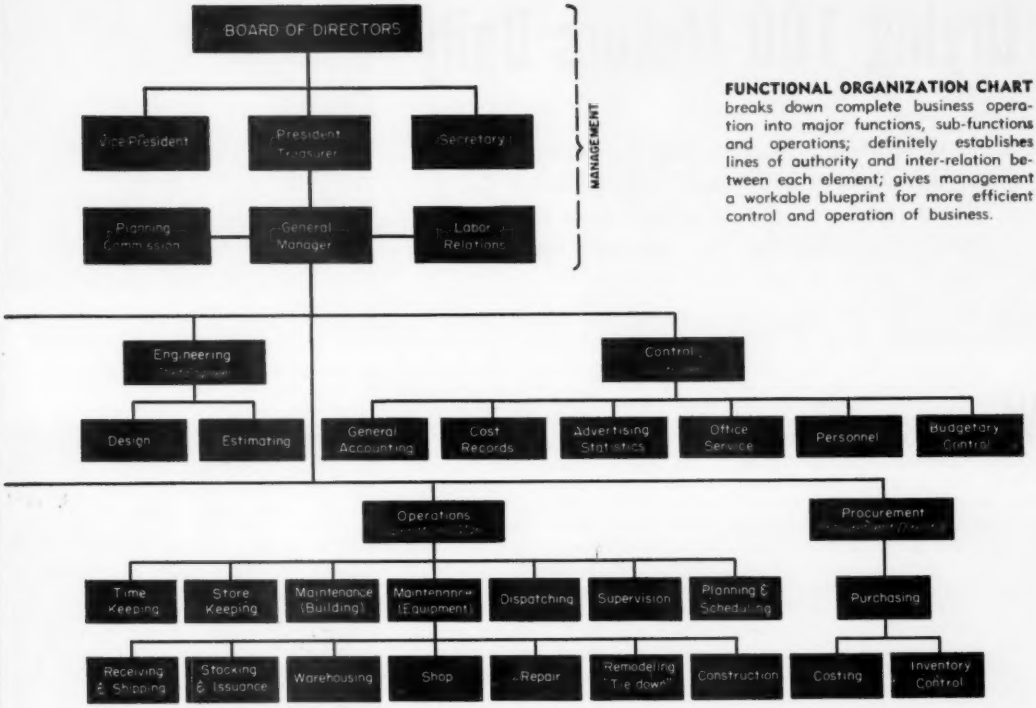
To illustrate, let's follow through one phase of a business operation. Keeping the general books, payroll records, and preparing profit and loss statements are *operations*. These, grouped together with similar or related operations, comprise the *sub-function* called Accounting. Records, expense accounts and other documents must be checked for accuracy, so these operations are grouped to create another *sub-function* called Audit. Accounting provides all the information necessary to indicate the trend in sales, expenses and profit. Audit assures the correctness of methods used and the accuracy of records maintained. Both these sub-functions enable management to plot a business course, hence become part of a *major function* called Control.

Similar ladders of functional responsibility and operation in other phases of the business culminate in other major functions. All are coordinated by *general management* which determines company policy.

Organization Chart

Perhaps the best way to picture management framework under functional organization is to develop an organization chart tailored to meet the specific requirements of the business at hand. The chart illustrated above was designed to fit the over-all construction, sales and service operations of the Sturgeon Electric Company. It is, in effect, a blue print of our complete organization as it exists today and acts as a "road map" to point out which department or function we must consult when we face an operational problem.

Developed on the recommendation of a business management consultant, the chart shows all of the major business functions, sub-functions and opera-



FUNCTIONAL ORGANIZATION CHART breaks down complete business operation into major functions, sub-functions and operations; definitely establishes lines of authority and inter-relation between each element; gives management a workable blueprint for more efficient control and operation of business.

tions with the lines of responsibility and authority clearly indicating the relationship existing between all elements. It may seem to be quite big and complex for an electrical contracting business. In actual fact, it isn't. It merely brings to the surface the numerous business functions which were in existence all the time but may not have been consciously recognized.

That some of these functions can be unintentionally overlooked or given little thought, as such, in many well-managed organizations is indicated in the following observation. Consider a single-ownership operation. The owner determines that inventory is low, discovers no cash on hand to replenish same, arranges to secure cash and orders the replacement stock. In doing all of this, he acted in the following multiple-functional capacities: Inventory Control (determining inventory status), Forecast (determining lack of ready cash), Capital (securing needed funds), and Procurement (ordering replacement stock). Now, the question is: While doing this, did this man recognize all of these business functions in their true meaning and realize their relative positions in his own business structure?

Would you as an electrical contractor recognize them in the normal pursuit of your business? Chances are that you would if you had developed your own management chart based on a functional organization setup.

Why Use the F. O. Chart?

There are many advantages to viewing your business operation from the functional organization angle and developing a comprehensive management chart. Such an approach will:

1. Inevitably lead you to recognize and acknowledge each of the component elements and their inter-relation in a complete business operation.

2. Focus attention on all the separate functions essential to the profitable continuance and possible expansion of the business; also additional personnel needed for expansion.

3. Show the multiple functions now handled by one man and indicate the required trained personnel necessary should this person be temporarily or permanently taken from the organization.

4. Reveal possible problems which might be encountered as a result of expansion.

5. Uncover overlapping of authority, duplication of effort, unbalanced delegation of responsibility and other wrong conditions. Management can untangle such snarls by developing a chart, with functional elements properly segregated and correctly related, and adding names of persons discharging specific duties in the proper squares. Here the chart serves as a corrective tool.

6. Give management a clearer picture and closer control of the over-all business operation.

7. Increase the over-all efficiency of the complete operation.

Functional organization is a definite asset to any business operation. It is based on logic and facts; provides the only set of infallible rules for business progress.

Any electrical contractor can review his business operation from this standpoint and develop his own management chart—either simple or complex depending upon his specific type of work. One precaution should be observed: All functions and operations performed in his office should be included to secure a complete picture. This should be done whether he does a number of them himself or has one or more persons to handle various operations.

Drying 100 Motors Daily

By establishing a separate, temporary operation on a production-line basis, Boese-Hilburn Electric Co., Kansas City, was able to restore more than 100 motors per day for flood-stricken customers.

By August Eckel

When the disastrous flood hit the greater Kansas City industrial area in July, Boese-Hilburn Electric Company (member NECA, NISA) had a modest motor repair department employing about six mechanics. A week later, this operation had expanded to include an additional 6,000 sq. ft. of floor space in an adjacent leased building; more equipment; approximately 40 extra men and an added investment running into several thousand dollars.

This was John D. Hilburn's contribution to Kansas City electrical industry's all-out cooperative effort to get flood-stricken industries back on their feet in the shortest possible time. That, in addition to the rehabilitation work his construction department was doing in the flooded plants.

To accelerate restoration of motors, Hilburn set up his temporary operation on a sequence, production-line basis; used fork-lift trucks and roller conveyors to simplify equipment handling; steam generators for cleaning; infra-red baking hoods for drying out; and long dual workbenches for assembly work. Each motor was carefully checked and tested before going back to the customer.

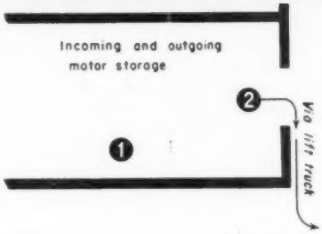
As added insurance that the work would be done efficiently and properly, he had supervisory personnel flown in from Allis-Chalmers' Norwood, Ohio, motor plant (Boese-Hilburn is an A-C Certified Service Shop).

Within two weeks after flood peak, approximately 100 motors per day were leaving the B-H shop to go back into industry and the goal of 150 units per day was in sight. Better than 1,000 mud-caked, water-soaked motors had already come into the shop and another 1,000 or more units were expected. How they were handled is shown in the accompanying photos.

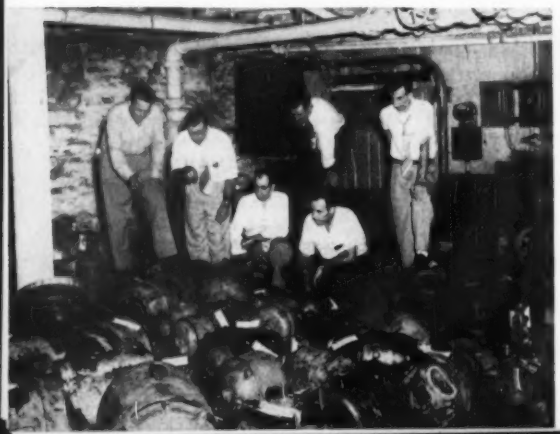
The Boese-Hilburn story is just one example of how the Kansas City electrical industry met the enormous challenge of the flood emergency. Other contractors and motor shops expanded facilities; improvised, bought, rented, begged and borrowed equipment to do a first-class job in record time. They have earned the grateful commendation of their customers.

8 Final check on a large motor is made prior to painting.

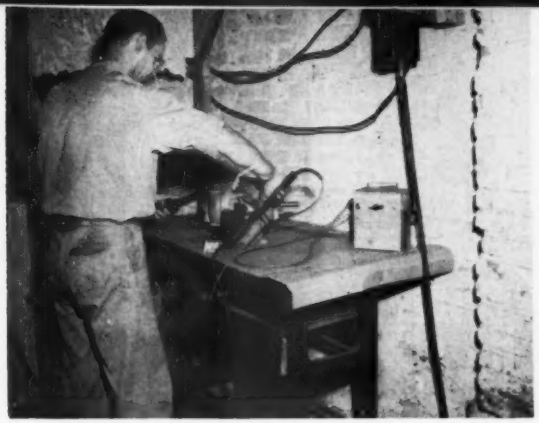
9 Spraying coat of gray paint on frame is last operation.



1 Hundreds of water-soaked motors await cleaning and drying operations; are inspected by John D. Hilburn (left) and supervisory personnel from Allis-Chalmers' plant.

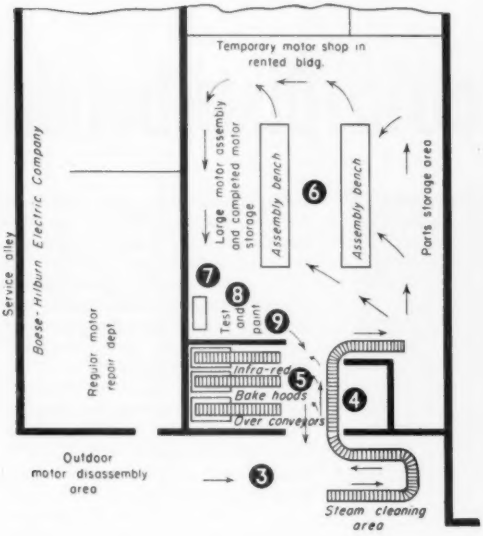


2 Fork-lift truck brings motors from storage building to outdoor disassembly area in service alley behind shop where the emergency reconditioning cycle begins.



7 Test table where restored motors are put through running, speed, Megger and hi-pot tests. Nearly 2000 motors were overhauled by Boese-Hilburn during this period.

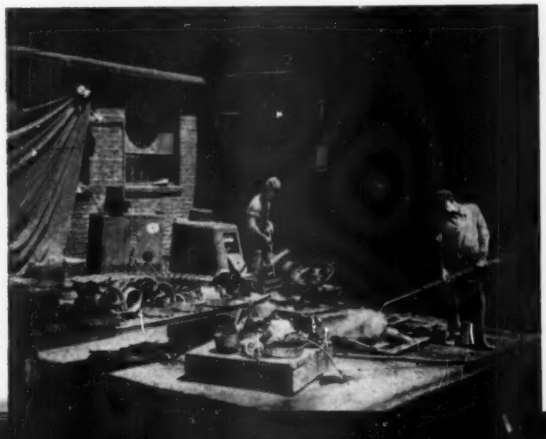
6 Dual lines of work benches where smaller units are assembled. Bearings and other parts are replaced if necessary. Large units are assembled on floor.



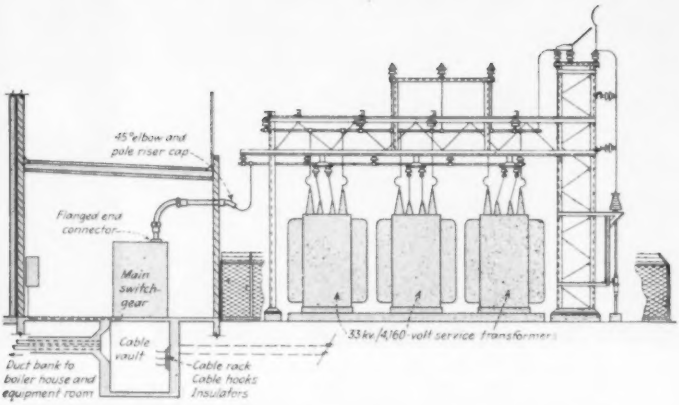
5 Units are dried out under infra-red hoods over three conveyor stubs. Hoods were made from Transite panels on angle-iron frames.

3 Thorough steam cleaning is given disassembled motor parts on conveyor in foreground. Cleaned motors are placed on conveyor and pushed into building.

4 Inside building stators and rotors are inspected, taken off conveyor and placed under infra-red hoods at rear; other parts continue on to parts storage area.



TRANSFORMER LEADS from outdoor substation to main switchgear are 500 MCM 5-kw cables, carried through brick wall of switchgear vault via 4-inch heavy Transite duct capped by 45-degree pole-riser elbows.



OUTDOOR SUBSTATION steps utility service from 33-kv to distribution level of 4160-volts. Feeders are dropped into cable vault, then to load-center subs.

Electric Distribution

New theories for electrical distribution, atmospheric control, materials handling and construction have made Lincoln Electric's new 17-acre plant one of America's most efficient factories.

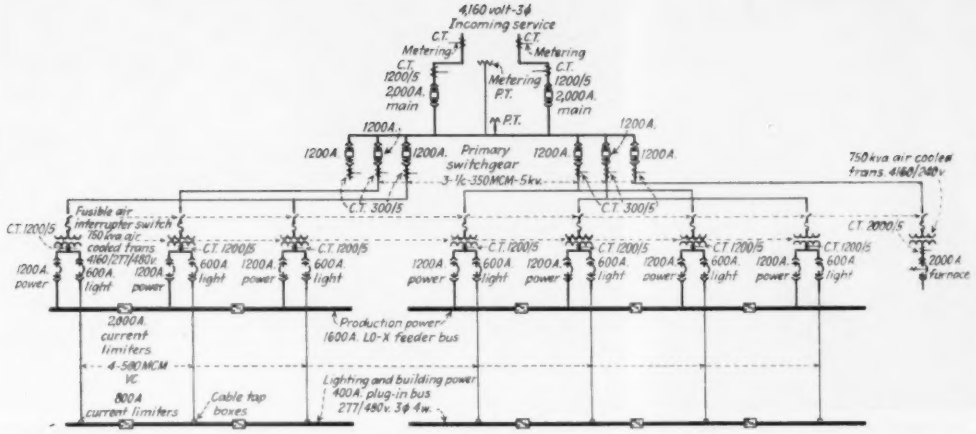
By Hugh P. Scott

LINCOLN ELECTRIC'S vast new $8½-million plant in Euclid, Ohio—combining radical new theories in electrical distribution, atmospheric control, handling of materials, production sequencing, construction and storage—may well merit reference as America's most efficient factory. For this 17-acre aluminum-sheathed windowless structure is far more than a drafting room creation. It represents three years of planning and the application of countless new ideas gleaned from employee contests, plant visitations, trade shows, conferences and experience. These ideas were tested practically before acceptance, with a full-scale $120,000 assembly-line mock-up serving as the production guinea pig. Such experimentation more than paid for itself the first year through savings in direct and indirect labor. A total of 34 persons were shifted from non-productive to productive labor. Direct labor costs were reduced 10% through increased efficiency. "Industry generally attempts to reduce costs by *solving* production problems", says A. T. Waidelich, The Austin Company's v.p. in charge of research, "but Lincoln has concentrated in *eliminating* them."

The plant is primarily a single-story welded steel structure measuring 1400-by 500-feet, with a centrally-located 60-foot-wide service corridor running below ground level for the entire length. Along this corridor there are seven 4160-277/480 volt, 750-kva air-cooled transformers (with space and feeder capacity for 14 additional units if and when required, a 1600-amp 480-volt 3-phase low-reactance power feeder bus, air and water service lines, lockers and sanitary facilities. Spaced along this quarter-mile service corridor are 11 stairways leading up to the production floor which is powered from below by the corridor-routed feeder, and from above by truss-supported runs of 400-amp 3-phase 4-wire plug-in busduct. Both busduct systems are segmented; the 1600-amp production bus sections connected through 2000-amp current limiting "Amp Traps", and the 400-amp power and lighting bus segments connected via 800-amp "Amp Traps". Connections between transformers and busducts are by way of low-reactance busses (in the underground corridor) and 4-cable 500 MCM VC feeders (to the overhead plug-in system).

Multi-voltage Service

In addition to the seven corridor-based 4160-277/480-volt transformers, the plant is served by a 750-kva air-cooled 4160/240-volt unit for laboratory operation, and a direct 4160-volt feeder between primary switchgear and a motor control center for the operation of large equipment (such as air and refrigerating compressors).

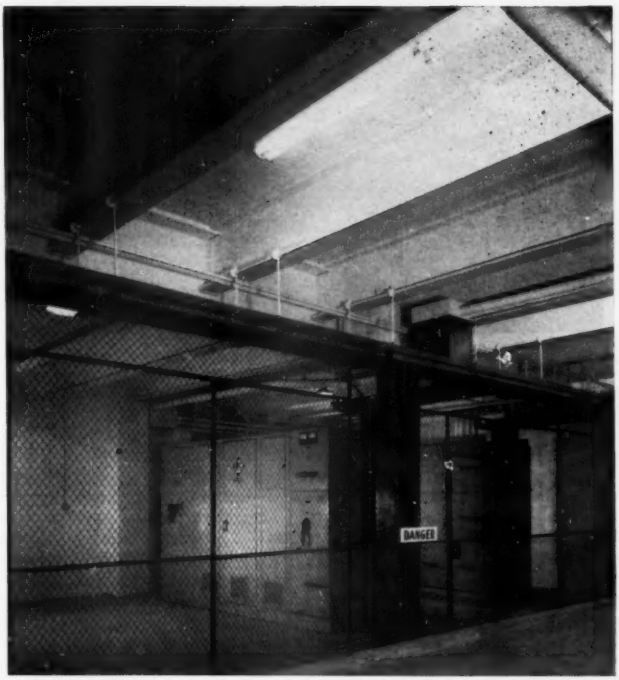


DISTRIBUTION SYSTEM consists fundamentally of twin incoming utility services, primary switchgear, underground feeders to local substations, cross-connected runs of low-reactance feeder bus and plug-in bus.

Ideas for Welder Production

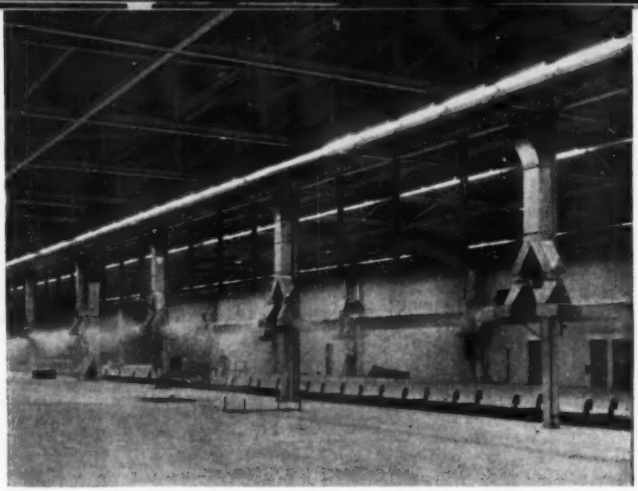
Primary switchgear consists of six 1200-amp draw-out automatic circuit breakers, fusible air interrupter switches and related metering equipment. Incoming power from the Cleveland Electric Illuminating Company's adjacent outdoor 33 kv/4160-volt substation is through six sets of three 500 MCM 5-kv cables, carried in 4-inch heavy Transite ducts aligned and supported by maple braces. Feeders from this primary switching center are dropped into a walk-through cable vault, are carried along vault walls on cable racks to the entrance of a 20-cell bank of fiberducts, thence underground to the service corridor, laboratory and equipment rooms.

Local control of power and lighting on the production floor is from nine compact 3-section control panels. These panels, from 3- to 5-feet in width and having up to 53 control stations each, are of welded steel-angle construction. Damper and power sections consist of air switches and gauges for economizers, unit heaters, cooling units and roof vents; typical power control stations including start and stop pushbuttons, green and red pilot lights, 5-amp control fuses and identification markers. Lighting sections combine both single-pole and 3-way switches, and are liberally fitted with drilled and blanked stations for spare circuits. All except night-light circuits are fused.

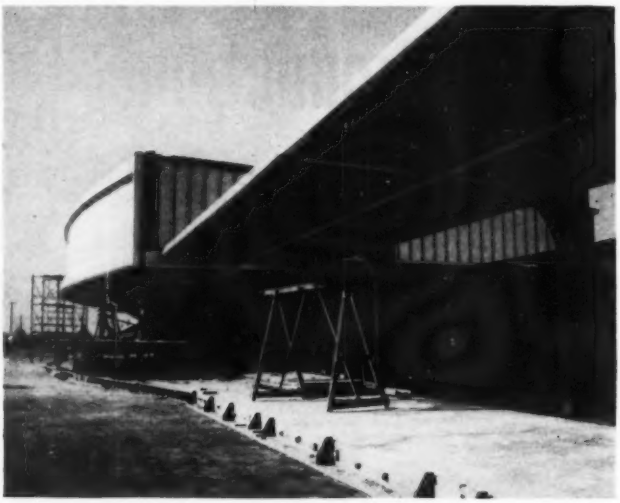


AIR-COOLED 750-kva 4160-480/277-volt substations are located in central underground service corridor beneath production floor; contain primary disconnect fuses, power and lighting distribution breakers; serve feeder- and plug-in bus runs.

EXTERIOR PANELS were secured to building framework by means of 10-gauge headless flux-filled studs.



OPEN FLOOR AREA, pictured prior to positioning of assembly-line equipment, indicates location of air-conditioning ducts, lighting fixture runs, roller-conveyors and plug-in busways adjacent to column lines.



ILLUMINATION for the modern entrance includes recessed lensed units in the canopy and half-shade incandescent units positioned along the edge of the roof. Wiring circuits are run inside of structural pipe.

With production and assembly lines running close to column lines, and with "visual inventory" storage concentrated along the center of the 60-foot column-to-column aisles at point-of-use locations, both the distribution of power and the concentration of lighting in the factory follows roof-truss patterns.

Plug-in busduct (277/480-volt) is supported by duct clamp hangers and 1½-inch angles welded to vertical members of truss webs, with motor starters and lighting contactors (115-volt coils) mounted beneath the busduct on 3-inch channels, likewise welded to vertical web members. Control circuits for the operation of these starters and contactors are run immediately above the busducts, carried in 4-by-4 inch ducts.

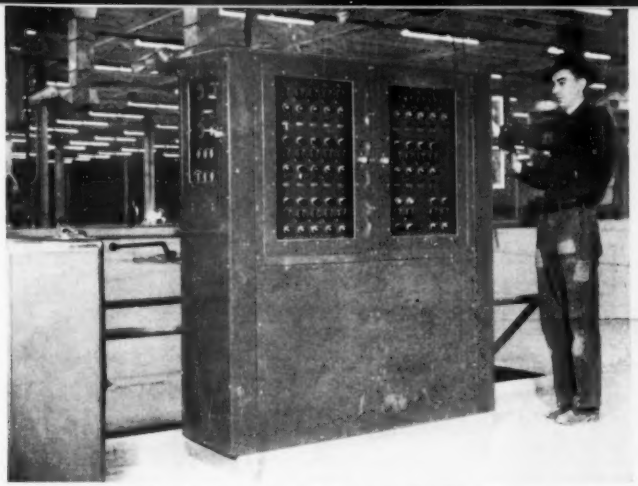
Inasmuch as the building is all-welded construction, and since foundation steel extends 13 feet below grade into fairly moist ground, no grounding system "as such" is required. Construction and foundation conditions, however, result in the effective grounding of the structure itself, so it is only necessary to ground electrical components to structural framework.

Emergency power for night lights and sump pumps, etc., is furnished by a 480-volt diesel-generator (capacity 100-kw) and locally-located 480-120/240-volt 3-phase 4-wire transformers. Power for starting auxiliary diesel is supplied by 36-volt wet batteries (six trays of three 2-volt cells) supported above the floor on wooden stands enamelled for acid resistance.

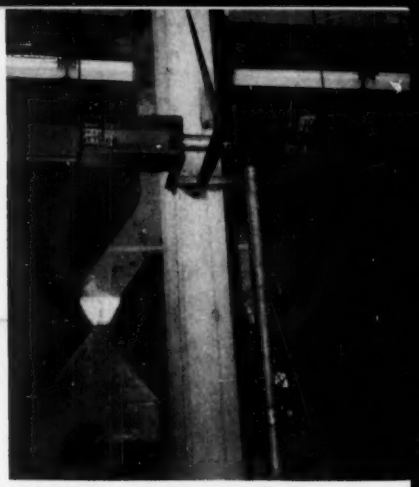
Electrical materials-handling equipment plays a major role in carrying raw materials from the 1400-foot receiving platform, through the 400-foot assembly lines, to truck and railroad shipping docks. Unloading raw materials from incoming vehicles and freight cars is facilitated by nine overhead cranes that can move freely along the entire receiving platform or down any of the twelve 60-foot assembly bays. A specially-designed "traveling hairpin" can be inserted under truck roofs for stacking assembled welding machines in the most remote corners of a van. Double-lift fork trucks can raise cases to heights of 15 feet to facilitate storage. Roller and variable speed conveyors serve all assembly areas. And freight cars can be moved along the enclosed railroad siding to any desired unloading point by means of electric car pullers.

Entrance Underpass

Entrance to the plant (for production workers, office personnel, executives and visitors alike) is through a separate, strikingly-modern building. From there, a wide double stairway descends to the service level, where a uniquely-lighted corridor underpasses a shipping railroad siding to reach the entrances to the lower level where office lobby, cafeteria and kitchen, conference and demonstration rooms,



CONTROL PANELS, throughout plant, designed by Austin and constructed by Lincoln, provide convenient means for controlling power, light, ventilating and cooling equipment. Panels provide ready means to regulate and operate equipment.



WELDING is used for fastening bus ways, air conditioning ducts, lighting fixture hangers, auxiliary equipment.

welding school and main service corridor are located. Above this corridor, at ground level, the production of welding equipment is carried on in half of the building while electrode manufacture is confined to the opposite end. Trusses of 60-foot span have been used with 40-foot jack trusses to reduce the number of columns in these production areas to nine per acre.

The maintenance department, research laboratory and all executive, production, sales and shipping offices are located in a two-story structure which has been erected on the main floor between the two manufacturing areas, each of which is operated as a completely self-contained unit. This revolutionary arrangement puts the offices and other auxiliary functions just where they should be for most effective service: adjacent to their related production operations for maximum supervision and coordination. Also, with employees reaching their machines via the underfloor corridors and access stairways, traffic circulation is removed from the manufacturing floor and safety is positively promoted.

New thinking on the subject of ventilation was prompted by the high clearances and overhead truss spaces in the plant for, had conventional air conditioning practices been followed, the resultant total volume of confined space would have resulted in a cooling load greater than the combined loads of power and lighting. By drawing outside air through roof intakes to truss-mounted cooling units located at the center of each 60-foot aisle, then distributing cooled air through ducts extending down columns to vents just a few feet above the heads of the workers, a continuous supply of tempered air is delivered to all populated areas (where it is needed). By this means, "mounds" of cool air are built up along assembly lines. Then, as the cool air sinks to the floor and spreads into stockpile areas, it is sucked upwards and exhausted through roof vents.

Functional Lighting

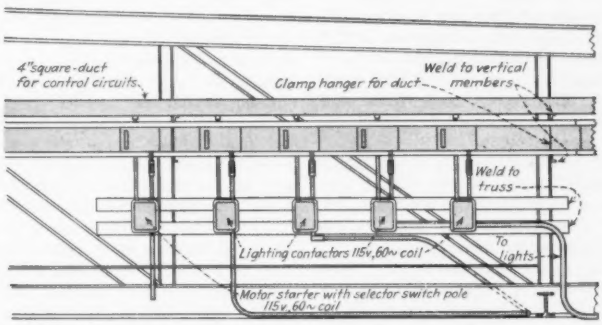
Lighting treatments vary in accordance with purposes and requirements of the several sections: functionalism emphasized along assembly lines, in drafting rooms, outdoor parking areas, shipping docks and utility spaces.

Each of the twelve 60-foot production bays is lighted by two continuous rows of 2-lamp 85-watt Daybrite fluorescent units with 4-lamp series sequence starting and 66 fixtures per row. Operation is at 277 volts, with series of fixtures staggered between power phases to insure continuity of illumination in the event of phase failure. Lines of light are suspended beneath roof trusses at an elevation of 23 feet, positioned 10 feet out from column lines. The result, similar to that of the air ventilating pattern, is the creation of "mounds" of light where it is most needed, with intensities of 34 foot-candles along assembly lines and levels of 20 ft. in center-aisle storage areas.

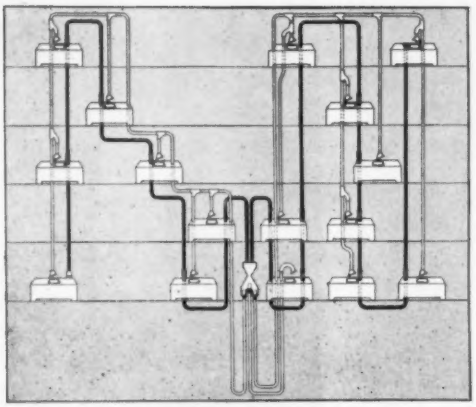
In the quarter-mile service corridor, 2-lamp 40-watt fluorescent units are mounted in tandem between joists of the production floor. Since joists are at right angles to the corridor and since fixtures are mounted above lower limits of joists, comfortable shielding is obtained and the corridor is illuminated for its entire length by glareless light.

Office lighting is likewise fluorescent; recessed 2-lamp units mounted in

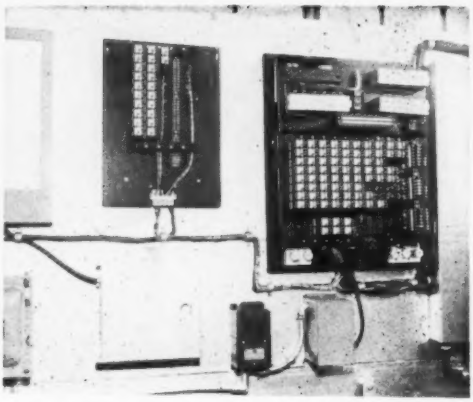
(*Continued on page* 128)


4"square-duct for control circuits
Clamp hanger for duct
Weld to vertical members
Weld to truss
Lighting contactors 115v,60~ coil
To lights
Motor starter with selector switch pole 115v,60~ coil

SECONDARY DISTRIBUTION is via plug-in bus-ways clamped to vertical members of roof trusses. Square duct carrying control circuits is mounted above plug-in runs, while motor starters and lighting contactors are supported beneath the duct by channels welded to truss steel.



TYPICAL pneumatic loop layout for automatic selective system with two loop lines.



ELECTRIC BRAIN reads data from carrier, and supervises entire system. Panel at extreme left is supervising annunciator.

Industrial Pneumatic System Uses Automatic Electric Dispatching

A pneumatic tube system using, for the first time in the United States, automatic electrical dispatching of the carrier to its destination has just been completed at the Housatonic Plant of the Bridgeport Brass Company. Employing the principles of automatic telephone switching, the new system greatly reduces the length of tubing required and eliminates manual central dispatching.

The installed system consists of nine stations on two "loops" expandable to 20 stations by cutting new stations into existing lines or extensions of existing lines with present central control. Since the principles are those of automatic telephone switching practice, subcentrals, trunk lines and loops could be added to extend the system indefinitely.

Of special interest to the electrical industry, automatic dispatching involves installation and connection of the central apparatus and control cable connecting with each station.

The system was developed by Mix and Genest, a German subsidiary of I. T. & T. and is handled in the U. S. by International Standard Trading Corporation, an I. T. & T. associate. I. S. T. C. contracts for the complete system installed. The electrical installation is subcontracted to electrical contractors or designated to the existing plant electrical department.

The general layout of the system involves two loops, each having one sending and one receiving tube. These tubes consist of electric-welded steel pipes with an outside diameter of four inches, identical to those employed in conventional pneumatic tube systems.

All *sending* inlets are inserted into the sending lines, and Y-formed castings with electrically-controlled levers inside are inserted into the *receiving* lines in such a way that the lever directs the carrier either into the receptacle underneath the Y branch, or through the other "leg" of the Y, to other stations on this line.

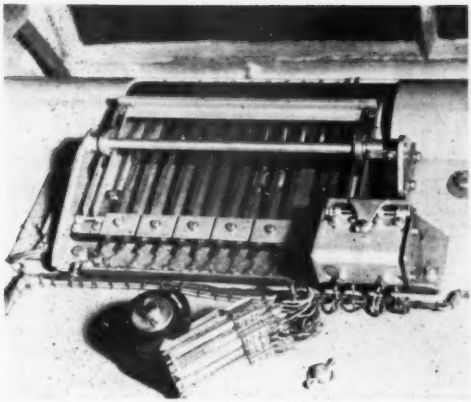
Loop A starts on the second floor of the office building (sales office) and serves three additional stations in this building, including the laboratories. Thence, the loop goes underground to an adjacent plant building, covers two additional stations in the plant, and ends above the Rolling Mill Office. Loop B begins at the Tube Mill Office on the other side of Grand Street, serves the Brinnel Room, and also ends above the Rolling Mill office. Both loops have a total capacity of ten stations per line.

On the roof of the Rolling Mill Office, the two loops are combined to form the Central Transfer Point or "heart" of the system, where each carrier is automatically tested, routed according to the signal it bears, and dispatched to its destination.

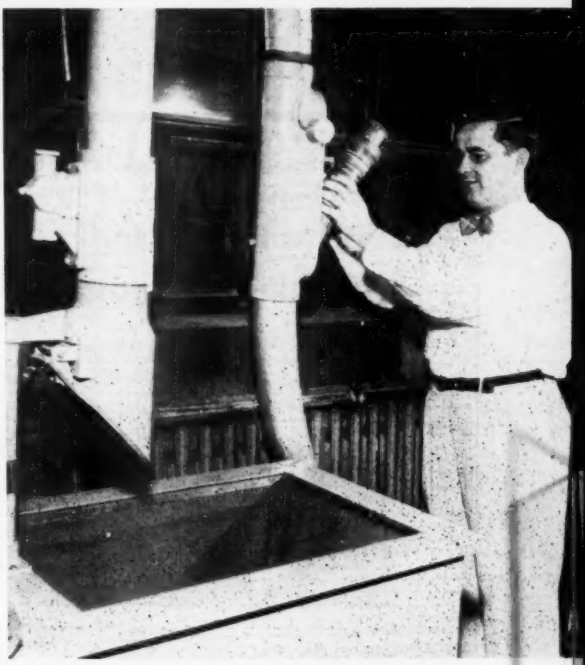
The carrier used to transmit messages under this system, though similar to the conventional type, differs radically in interior design, making it possible to control electrically the route of the carrier to the desired destination.

On the surface of each carrier are ten fixed and two dial rings. The dial rings are stamped with digits from zero to nine and can be rotated by the operator. By rotating the rings, the operator is able to connect electrically one of the 10 fixed rings with the two dial rings, thus enabling him to dial as many as 99 different electrical combinations, to guide the carrier through the tubes to the desired station. Let us assume that a message or brass sample is being sent from a shop station on Loop B to one of the two laboratory stations on Loop A.

First, the message is inserted into the carrier. The operator then adjusts the dials on the carrier to the number of the laboratory station, inserts the carrier into the sending inlet, and starts



FINGERS make electrical examination of carrier, report to central which tests traffic situation and guides tube on its way.



CARRIER with destination number dialed is inserted in sender tube.

Bridgeport Brass installs first electrically controlled automatic selective pneumatic tube system for plant and office intercommunication.

By W. T. Stuart

it on its journey. Actually, it makes no difference whether another carrier, coming from the same or another station, immediately precedes or follows it. The carrier travels through the tube until it reaches the Central Transfer Point, where it is dispatched into the Control Device. The Central Transfer Point, with the control devices, the X-shaped central switch, the relay panels, signal board, and rectifier comprise the "brain" of the system. These five elements have the following functions:

The rectifier supplies the necessary direct current of 60 volts used in all control circuits from a power line (440 volts, 3-phase, 60 cycles).

The control devices—one for each sending line—are equipped with small servomotors that permit the carrier to enter and re-start. Each control device has 12 contact springs corresponding to the ten-plus-two rings on the carrier's surface. As soon as the carrier has arrived in its control position—supervised by additional contacts and blocking devices—the 12 springs touch the carrier rings and connect the carrier electrically with the relay panel. Several relay chains then begin the search until it has been determined to which outgoing line and station the carrier has been dispatched. At the same time, the dialed station number is stored in another relay chain and reported to the signal board where it can be identified by supervisory personnel.

Meanwhile, other relays have determined if another carrier has just been dispatched into this line. This is imperative because all carriers travelling through the receiving line are spaced at intervals of five to 20 seconds, depending on the length of the line, to avoid any collision that might result from the meeting of slow- and fast-traveling carriers. The receiving line is also checked by the relay panel to determine whether sufficient vacuum is being provided.

Under normal conditions, all test operations are completed in approximately 0.2 seconds, during which time the X-shaped central switch has been energized. Two guiding levers with two solenoids are built in this switch and, in conjunction with the relay panel, direct the carrier into the proper receiving loop.

The carrier is then released by the control device and falls by gravity, guided by the proper lever of the central switch, into the receiving line A, where vacuum power draws it forward at a speed of approximately 25 feet a second. The carrier, now approaches the first switching station. Approximately 12 feet in front of this station are two sets of brush contacts which "examine" the carrier. If the space between these contacts corresponds exactly to the space between one of the fixed and one of the dial rings of the carrier, it is automatically discharged at Station 1. However, should the carrier be dialed for any other station on Line A, it passes the brushes of Station 1 without establishing contacts.

These brush contacts, together with the carrier dialed for this station, close a circuit which energizes the solenoid of the Y-Branch. The carrier is then deflected from the main line into the receptacle of this station. Discharging the carrier closes another contact, resetting the lever of the Y-Branch and turning off the signal lamp of this station, which was lighted up while the carrier was in the control device. The carrier, having arrived at its destination, is then opened.

Power circuits are carried in multiple conductor rubber jacketed control cable strapped to the pneumatic tubes. At each station the cable terminates in a cabinet with terminal strips providing for connection of station circuits.

Motor Shops

Customer's Name	Empire NO.	P.O. NO.	Description	Rec'd	F	Del'd
Edmund Compton	E 942	341	1/6 HP GE 1725 1ph	7-2-49	F	7-5-49

EA Nº 968

CHARGE TO
NAME
STREET CITY
P.O. TEL.
CHECK REPORT RELEASE STOCK MACH. ASS. TEST
APPL.
MAKE
H.P.
KIND
TYPE
FRAME
FORM
MODEL
STYLE
NO.
VOLTS
AMP.
PHASE
CYCLE
RPM
BOT.
REPEAT

BILLED
FROM
CREDIT RACE
REC'D.
FIN.
SHIPP'D.
S PRICE
CSTMR. APPROVAL
QUANT. PART NO. EA. PRICE

G. OVERHAUL
INST. BEARS. (S)
SOLDER ROTOR
SOLDER COMM.
TURN COMM.
V. C. COMM
TURN COLLECTOR
SHAFT
TURN V. F. + O
SLEEVE F. + O
SPRAY F. + O
TURN E BELL (S)
DC. STATOR-FLD.
RING ARMATURE
LEADS FT.
V. D. STATOR
V. D. ARM.
SPRAY-PAINT
COND. OF - RPS
FR. BEARG.
O. BEARG.
POT. SWITCH
STAT. SWITCH
SH. CIRC. REV.
NECKLACE
COMM.
COLLECTOR
CAPACITOR
DC BRUSHES
AC BRUSHES
BR HOLDER
THERM. PROT
RUBBER WTG.

CHECKING, rather than writing, saves time and effort when a motor is received in the shop of the Empire Electric Company of Boston. Cards are filed numerically by job number. Master Book (typical page shown) lists customers' names, purchase order and job-card number, facilitating rapid checking of motor-repair status.

Check Sheet Speeds Motor Checking

The mechanics of checking-in a motor have been reduced greatly in the shop of the Empire Electric Company, Boston, Mass., through recognition of the commonly-known fact that it is easier and faster to make a check-mark than to write a word or phrase. Therefore, except for writing in the customer's name, address, etc., the condition of a motor and the estimated repairs can be indicated with checks. These checks indicate whether a motor is due for a general overhaul, renewal of bearings, undercutting of the commutator, turning of end bells, winding of armature or what have you. When the work is actually performed, the shop electrician fills in the remaining spaces, indicating the quantity of material or parts used. With the estimated trouble checked, the parts required indicated plainly and, (on the back of the same card) the hours of labor and test data recorded, billing is fast and sure and the status and history of each motor is recorded for rapid reference. Each job-card carries a separate number and cards are filed numerically. In case these numbers are forgotten by a customer who wishes to know the status of his job, the number can be quickly ascertained by consulting a Master Book containing the customer's name, the original purchase order number, the Empire job-card number, a brief description of the motor, and the dates the motor was received, finished and delivered. Enthusiastic comments mark the years that this system has been in use.

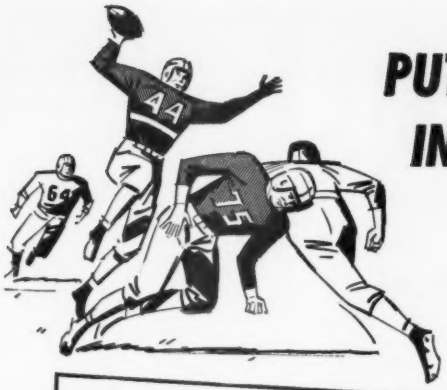
Outdoor Oven Has Dolly-Type Burner

When the outdoor brick burnout oven constructed by the motor repair department of the Wazee Electric Company, Denver, Colorado, is unloaded, the burner comes out with the equipment. Unlike most ovens, the burner is not stationary, but is an integral part of the dolly on which the equipment rests when being burned out.

The brick oven is 43¾ inches high; 65 inches deep and 48 inches wide; has a 35-inch clearance from the top of the burner grate to the top of the oven (inside dimensions). The burner grate is 46 inches long, 43 inches wide, and keeps the equipment nine inches above the oven floor. It is a unit made of steel tubes mounted on four large casters which ride in two channel-iron "tracks" set flush in the concrete oven floor and apron.

Each of the 12 parallel tubes in the grate is a burner with two rows of holes drilled along its full length near the top; is fed by a larger lateral tube to which the main gas connection is made. Motors do not touch the burner tubes but rest on ¾-inch steel rod reinforcing welded to the top of the tubes between the two rows of holes. Two steel doors in front enclose the oven; are cut out to fit over the protruding gas pipe connection.

BURNER-DOLLY holds equipment in this burnout oven; rolls in and out of enclosure for loading and unloading; has flexible gas line connection.



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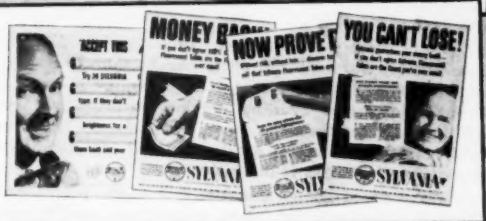
Sylvania's triple-threat program sells... SELLS... SELLS!

1. **Three powerful personalized mailings** are yours . . . for less than the postage. Imprinted with your name and address . . . mailed by Sylvania to *your* selected lists of prospects.

2. **Full-page ads in National Magazines,** including Time, Business Week, Newsweek and others will feature the Sylvania emblem and direct prospects to *your* door.



3. **Nation-wide Television Show** "Beat the Clock", over CBS-TV tells millions more about the quality of Sylvania products and plugs *your* Qualified Lighting Contractor emblem.

In addition you get free ad mats, radio announcements, speeches and a valuable manual on how to plan a fluorescent lighting installation. The coupon brings you full information. Mail it NOW!

This emblem on your truck, window, stationery identifies you as the Qualified Lighting Contractor in your community.

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FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; PHOTOLAMPS; TELEVISION SETS

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New York 19, N. Y.

Please send me full information about Sylvania's big sales-building campaign for Electrical Contractors.

Name_____

Street_____

City_____ Zone____ State_____

"DOW CORNING SILICONE ELECTRICAL INSULATION MULTIPLIES THE SERVICE LIFE OF A HARD-WORKING MOTOR BY AT LEAST TEN TIMES."

Mr. A. O. Kleen, Owner,
THE ELECTRICAL SERVICE CO., INC.
Austin, Texas

SERVICE is the buy-word in rebuilding motors. And service is more than courtesy, prompt handling and expert craftsmanship. In many cases, satisfactory service depends upon your ability to make standard equipment stand-up under highly specialized conditions.

That's where Class H insulation made with Dow Corning Silicones comes to the rescue. It's a plus value that distinguishes a progressive and growing shop from the conventional and static operation. It can save many thousands of dollars for your customers and it brings you more profit and prestige.

Start with this fact. Dow Corning Silicone Class H insulation is no more difficult to handle than Class B insulation, and it carries a much better profit margin. It earns that extra profit many times over by making hard-working motors last 10 times longer than they ever did before. That's why more and more maintenance, production and top management men are asking for Class H insulation.

Proof lies in the fact that many plants now specify Class H exclusively for pump motors, fan and blower motors, crane hoist motors, motors in reversing service, powerhouse auxiliary motors — critical motors of all kinds. Production men have also found that they can save thousands of dollars by using Class H to up-rate motors by as much as 50%.

And here's another fact to remember. Experience shows that the motor repair shop that places the first Class H job in any industrial center starts a potent word-of-mouth advertising campaign. And that's the best kind of advertising money can buy; the most certain way to win new customers and to increase your total volume of business. That's what we mean when we say:

Dow Corning Silicones Build Rewind Business!

Write Today

For more information, technical or sales assistance, call our nearest branch office or write to Dept. G-10.

DOW CORNING CORPORATION
MIDLAND, MICHIGAN

ATLANTA • CHICAGO • CLEVELAND • DALLAS
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DOW CORNING SILICONES

ELECTRIC BLOWER is added to gas burner connection when hot flame is needed; also serves to cool off oven after gas has been shut off.

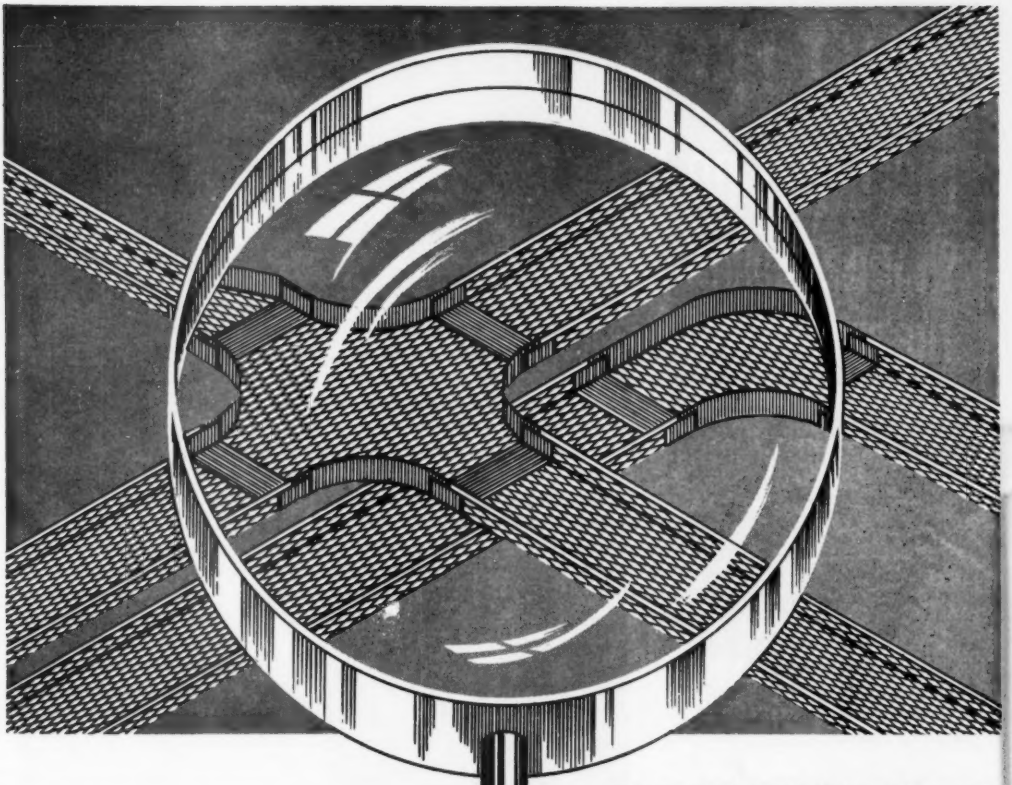
Normally, a low heat gas flame is used to burn out the insulation on motors and other equipment. Should a hotter flame be desired, a small electric blower is added to the gas valve at the front end of the burner connection. The blower is also used to gradually cool off the oven after the gas has been shut off. Cool air emerges from the burner tube holes and mixes with the heated air which eventually goes up the natural draft stack.

The oven will accommodate motors up to 100 hp. (900 rpm) in size. Typical burnout times are: two hours for a 5 hp unit; three hours for a 25 hp motor; other time varying with the size of unit, type and condition of insulation.

Compact Area For Small Motor-Dip Bake

Dipping and baking of small motor repairs are separated from the larger oven and department used for heavier equipment at the American Electric Works in Columbus, Ohio. By doing this, owner E. A. Williams finds he has been able to reduce operating costs, increase over-all shop efficiency and give his customers speedier service on smaller work.

A small area on one side of the shop contains the necessary equipment—an infra-red oven and floor dip tank. The octagonal-shaped oven (made of sheet steel troughs on angle-iron frame) is 27 inches deep, 45 inches high and 52 inches wide. Each side of the unit has three tiers (three lamps each) of 375-watt infra-red lamps. The top and bottom rows of lamps are placed at a 45-degree angle to throw heat



MAN-HOURS CUT

...and Money Saved... With the New System of

COPE CABLE TROUGH

To save man-hours in today's Emergency is vitally important. That's why utilities, industrial plants and government agencies have installed the new simplified, versatile and time-saving Cope Cable Trough in preference to using old-fashioned methods of carrying control cables and instrument tubing.

During all stages—from the moment the Design Engineer specifies the use of Cope Cable Trough—during the time it is installed—and at the time the cable is being laid—man-hour after man-hour is saved by using Cope Cable Trough. The Design Engineer can order a complete installation as easily as a pipe system. The men in the field find it simple to install—where necessary, trough can be cut and fitted with a hack-saw—the only installation tools required being a pair of pliers and a wrench. Cable can be easily installed in the trough. And to meet unusual conditions, the Cope Engineering Staff will design special fittings for customers.

Yes! Cope Cable Trough is doing its part in saving —saving labor, saving material and saving costs.

Write today for your copy of the new bulletin on Cope Cable Trough.

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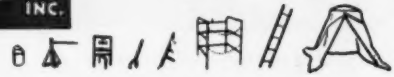
T. J. Cope INC.

You know Cope by these Products . . .



DON'T LET
DUST, DIRT OR
WEATHER SHORTEN
THE SERVICE LIFE
OF YOUR MOTORS

BALDOR

Streamcooled

BALL-BEARING MOTORS

These motors are SOLIDLY ENCLOSED, cooled by an outer-mounted fan in the bell-end. They cannot inhale dust or dirt and will operate efficiently in all kinds of weather.

BALDOR Streamcooled Motors require no dismantling for cleaning. Thus *less servicing* . . . no interruption of service. Let us tell you more about these long service-life BALDOR Motors.

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Baldor

Sold and serviced in more than 300 Trade Centers

FLOOR DIP TANK is in front of oven door; simplifies transfer of dipped motors to oven dolly.

LAMPS ARE POSITIONED to concentrate heat on work; are separated by metal partitions which add rigidity to lamp-trough sides of oven.

rays downward and upward on the work. No lamps are installed in the top of the oven. Metal separators form individual pigeon-holes for each lamp; add rigidity to the lamp trough. Lamps are circuited and controlled in "rings" at the front, center and back of the oven. Each circuit contains six lamps (three on each side of the "ring") and has a manually operated toggle switch on the oven exterior. Service is from a 30-ampere, 3-pole, 230-volt switch.

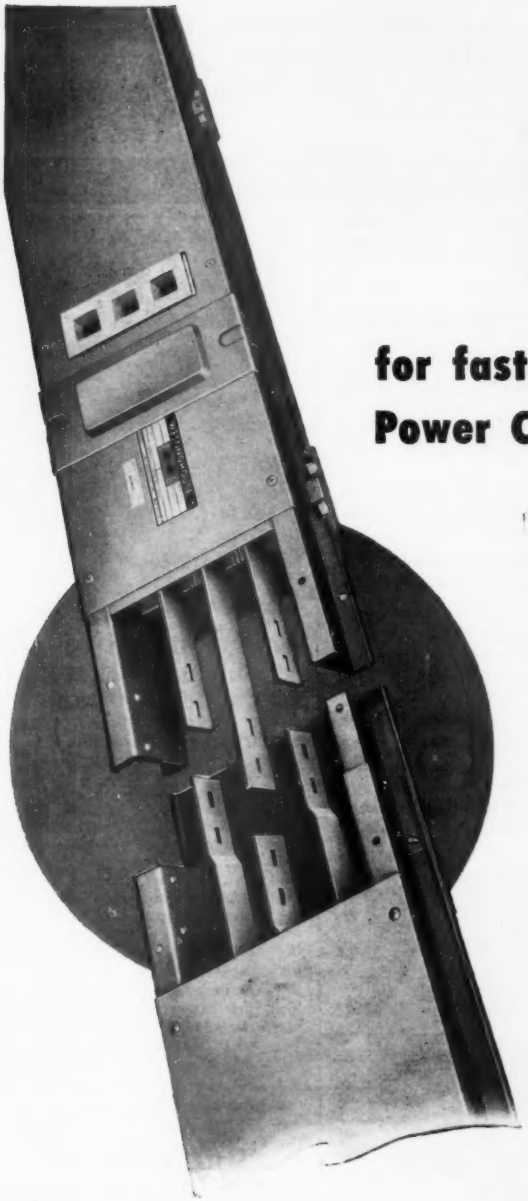
The oven is loaded by using a small dolly which raises the motors above the level of the bottom rows of lamps. A metal tray slides in the frame between the casters and top grid; can be easily removed to clean off varnish drippings.

Before motors are placed in the oven, they are dipped in a flush-type floor tank which is 30 inches wide, 40 inches long and 60 inches deep. A flanged metal cover is seated in a trough around the perimeter of the tank just slightly above floor elevation. Equipment is lowered into and raised from the tank and placed on the dolly with a chain hoist.

Rotors Held By Sliding Cradle

Small rotors are held in position by sliding arms and clamps, held by rotating bench blocks, in the shop of the Tennessee Electric Motor Service, Nashville. Threaded handwheels adjust the tension on the clamps, attached to the arms, and on the segments of the rotating block, attached to the work bench. Since arms can be moved inwards or outwards to accommodate small or large rotors, and since the block can be rotated as desired for the convenience of the worker, the device is in constant useful service.

ROTATING CRADLE holds rotors in position while electricians wind and connect coils on fractional horsepower units.



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- Prefabricated sections, any length . . . convenient to handle, mount, and install with channel-type splice plates (illustrated).
- Plug-in receptacles every foot . . . eliminate long, secondary cable runs, facilitate rapid machine tie-ins, any time.
- To extend power-line runs . . . simply add sections of duct.
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- Standardized ells, tees, crossovers . . . no problem with tight layouts, turns in any plane.
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- Higher carrying capacity pound for pound than cable or conduit.
- 4 types of Westinghouse Bus Duct meet all load requirements, any service condition from transformer to machine.

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BUS DUCT

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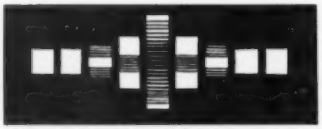
Applicable to Pulsating or Interrupted D-C as well as to A-C Supply Circuits



EASY TO READ—Vibrating reed tips form a clearly defined pattern

Here are other advantages of Frahm Resonant Reed Frequency Meters gained by the simplicity and unfailing accuracy inherent in these instruments.

- **DEPENDABLE**—permanent calibration is a natural characteristic of tuned reeds.
- **STURDY**—there are no delicate pivots, jewels or moving parts.
- **LITTLE MAINTENANCE**—the result of simple, sturdy construction.
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- **UNAFFECTED BY EXTERNAL FIELDS**—damping effect on natural reed frequencies is negligible.
- **INDEPENDENT OF LOAD, POWER FACTOR or PHASE SHIFTS** in supply circuit.

FRAHM Frequency Meters are available in switchboard, miniature and portable types. We invite correspondence regarding applications which require special modifications of range, method of actuating, scale graduations or other design characteristics.

We'll send you a bulletin that contains a wealth of information on this subject. Write today for Bulletin 32-ECM.

(Model 1B—Battery Operated Set)

FOR LOW-RESISTANCE MEASUREMENTS BETWEEN 100 AND 10,000 MICROHMS

Megger® Low Resistance Ohmmeters in Portable Types for Field and Shop Use

Self contained battery-operated and rectifier-operated types of Megger Low Resistance Ohmmeters have just been developed. They are designed for hard routine and emergency service in measuring contact resistance, such as in circuit breakers, relays, switches, bonds, connections and joints, commutator bar-to-bar tests and the like.

These portable instruments (weight 19 lbs.), are designed for low resistance measurements in the shop and in the field. They are of moderate cost and are accurate to within 1.5% of full scale deflection.

Model 1B operates from two 4 FH dry cells mounted inside the case.

Model 1R operates from a rectifier, built inside the instrument case, for connecting to 115 volts, 50-60 cycles.

Both models have a range of from .001 to .010 ohms. These new instruments operate on the same crossed-coil ohmmeter principle as the Ducter Low-Resistance Ohmmeter, with pointer indications of resistance and no necessity for balancing or voltage adjustment. Scales have fairly uniform graduations and are approximately 3¼" long. Anyone can operate this equipment—no special training or experience is required.

For particulars and prices write for Bulletin 24-46-ECM.

Practical Methods

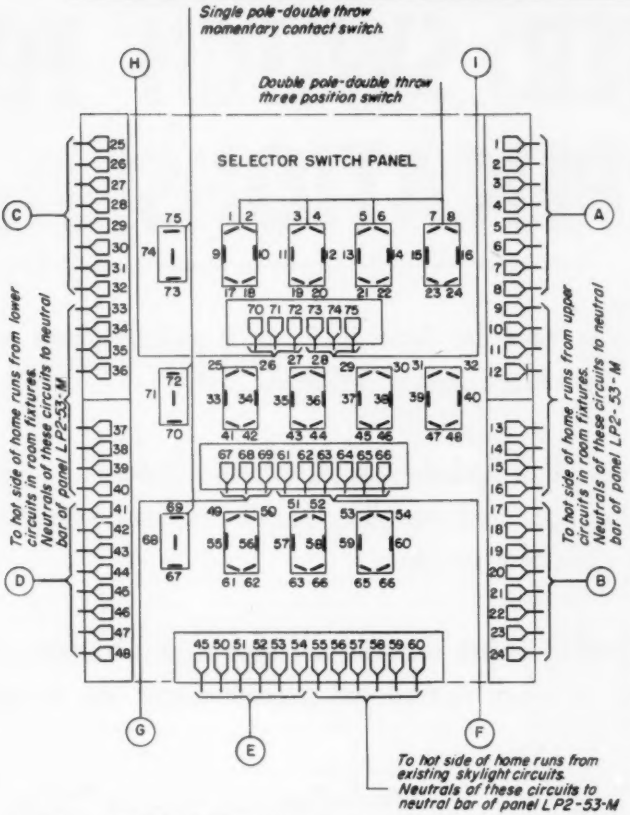

Single pole-double throw momentary contact switch.
Double pole-double throw three position switch
SELECTOR SWITCH PANEL
To hot side of home runs from lower circuits in room fixtures. Neutrals of these circuits to neutral bar of panel LP2-53-M
To hot side of home runs from upper circuits in room fixtures. Neutrals of these circuits to neutral bar of panel LP2-53-M
To hot side of home runs from existing skylight circuits. Neutrals of these circuits to neutral bar of panel LP2-53-M

FIG. 1—SELECTOR SWITCH PANEL showing double-throw, three-position toggle switches, remote control momentary contact toggles and terminal strips. Circled letters identify connections to contactor and standard lighting panel terminals.

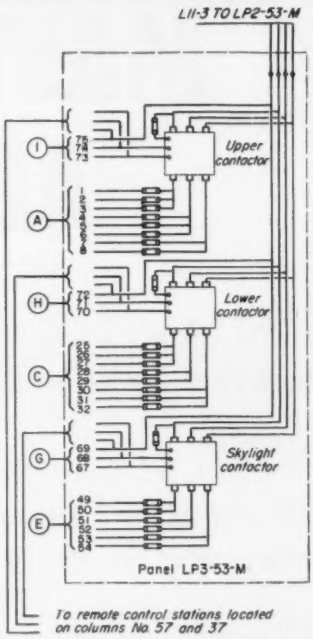


FIG. 2—CONTACTOR PANEL is for remote control of all circuits feeding upper and lower sections of chandelier-type fixtures and skylight units. On remote control position, these circuits are fused.

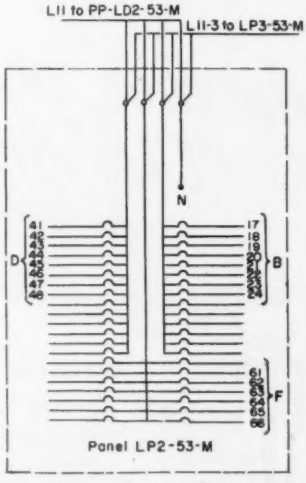


FIG. 3—STANDARD LIGHTING PANEL provides circuit breaker control and protection of circuits when selector switches are on manual position.

Selective Control of Large Area Lighting

WIRING

Selective and flexible control of lighting circuits in public meeting areas such as lecture halls, meeting halls in commercial buildings, and even classrooms in schools and industrial plants has been a problem for some time. If most of the house lights had to be "doused" during a film or slide lecture session or other type of presentation, generally a person had to find the lighting distribution panel and flip as many toggle switches as there were circuits to be turned off. When the lights were to be turned on again the procedure was reversed.

One method of resolving this problem and simplifying such lighting control was devised by Ralph H. Decker, Inc., Chicago consulting electrical engineers, during a dc to ac wiring system changeover at the Drake Hotel in Chicago. Installed by Fischbach, Moore & Morrissey, Inc., electrical contractors, the new system utilized a selector switch panel and contactors with standard lighting control panels.

Decker's plans and specifications called for recircuiting all ceiling outlets and skylight circuits in the Drake's Gold Coast Room, and connection of same to a selector switch panel, plus the installation of two remote control stations at strategic locations in the assembly area.

NOW...STOCK AND USE MASTER SWITCH FOR APPLICATIONS . . .

YES! **Now you can fill any need for Type A, C, or D switches from one magnificent line of BullDog Vacu-Break Master Switches.**

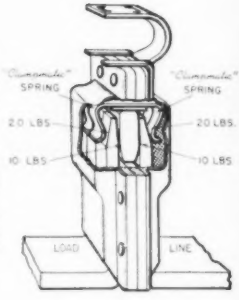
NOW! **End chaos of hundreds of confusing switch catalog numbers . . . *work with just 38!* Order from one line, stock one line, install one line. Save time, money, effort wherever you use safety switches.**

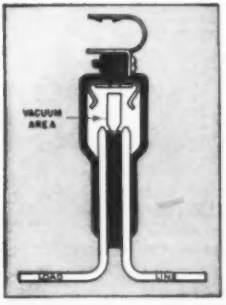
NOW! **A great, tested BullDog switch that fills all Type A specifications, yet sells at C prices, to end today's switch turmoil and streamline your use of Type A, C, and D switches!**

Another great BullDog first!

Exclusive Clampmatic Contacts!

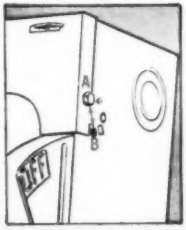
"Clampmatic" is a method for obtaining extra and enduring contact pressure between switch jaws and blades. In ordinary switches, new jaws exert about 10 lbs. pressure on blade. But in Vacu-Break Switches, the strong steel Clampmatic spring augments this with 20 lbs. on both "line" and "load" sides of jaws. Thus, Clampmatic provides a total of 30 lbs. of contact pressure between both sides of blade and jaw for "bolt-tight" contact.





Exclusive Vacu-Break Principle!

Dangerous arcs are quickly snuffed out by lack of oxygen in BullDog's exclusive Vacu-Break arcing chamber. This eliminates excessive arcing which, in ordinary switches, causes burning, pitting and rapid deterioration of contacts.



Voidable Cover Interlock!

Interlock: With interlock pin at Hole A, cover cannot be opened unless switch is OFF. Cover must be fully closed to throw switch ON.

To void interlock: Simply push interlock up and insert interlock pin in Hole B. Switch can then be thrown ON or OFF with cover open or closed.

BULLDOG VACU-BREAK ALL TYPE A, C, AND D AT TYPE C PRICES!

All the famous BullDog features!

- Vacu-Break principle of circuit rupturing
- Self-aligning Clampmatic Contacts
- Quick-make and quick-break
- Anti-creepage corrugations on switch bases and arc chambers
- Solderless cable terminals (Wire Grips)
- Horsepower-rated . . . Standard and Conditional
- Silver-surfaced current-carrying parts
- Voidable cover interlock
- Spring reinforced fuse grips
- Ample supply of conveniently located concentric K.O.'s
- Rear wiring gutters in 400-ampere and larger switches
- Generous wiring space in all switches

REMEMBER! Just 38 great Master Vacu-Break Switches replace hundreds of Type A, C, and D safety switches!

WRITE DEPT. 453-B FOR DESCRIPTIVE FOLDER

BULLDOG

BULLDOG ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN • FIELD OFFICES IN ALL PRINCIPAL CITIES

IN CANADA: BULLDOG ELECTRIC PRODUCTS OF CANADA, LTD., TORONTO

THE LEADER IN FLEXIBLE ELECTRICAL DISTRIBUTION

TAILOR-MAKE YOUR OWN

CONDUIT OR PIPE BENDS

RIGHT ON THE JOB

...simple, quick with the

GREENLEE HYDRAULIC BENDER

Yes, quickly make bends *exactly* as you want them, when you want them, where you want them. Compact, portable GREENLEE Hydraulic Pipe and Conduit Bender lets you do this in a jiffy. *One-man operated* to produce smooth, accurate bends in just a few minutes . . . in pipe up to 5", rigid and thin-wall conduit, tubing, bus-bars. Owners report timesavings up to 60% and more, elimination of cost for manufactured bends and fittings, and "clean", tailor-made installations every time. Get facts now on this time-saving tool that often pays for itself on first few jobs! Write for free Bender Booklet, Greenlee Tool Co., 1750 Columbia Avenue, Rockford, Illinois.

TOOLS FOR CRAFTSMEN

GREENLEE

Other GREENLEE timesaving tools for electrical work: Hand Benders; Joist Borers; Cable Pullers; Knockout Tools; Auger Bits and Drills.

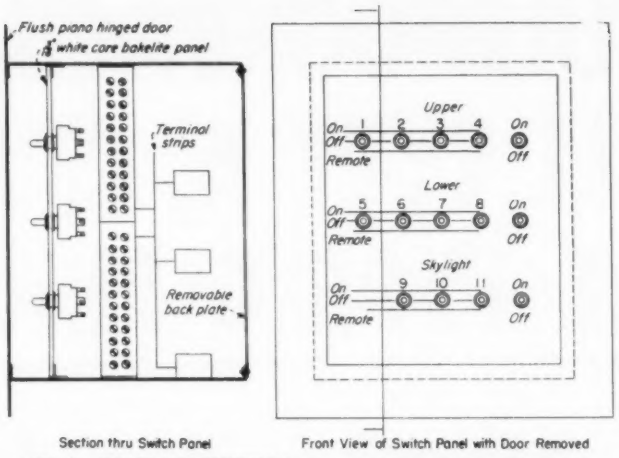


FIG. 4—FRONT AND SECTIONAL views of selector switch panel servicing all lighting in the room. "On and Off" toggles at right are momentary-contact type for remote control of circuits from this section.

The selector switch panel (Fig. 1) contains eleven two-pole, double-throw, three-position toggle switches; three single-pole, double-throw, monentary-contact toggle switches and terminal strips for making 75 connections. Each double-pole switch controls two lighting circuits. In center position, the switch is "off"; in the upper position, it throws the circuits on "manual" control from the lighting panel; in the lower position it throws the circuits on "remote" control through a contactor panel.

The three-position switches are mounted in three separate groups: a top group of four to control "upper" circuits in the chandelier-type fixtures (upper and lower half of chandeliers fed by separate circuits); a center group of four to control the "lower" chandelier circuits; and a bottom group of three switches to control skylight units.

When these switches are in the "remote" position, the respective circuits are controlled through a contactor panel (Fig. 2) containing one contactor for each of the three groups mentioned above. Each contactor can be operated by a single-pole, double-throw, momentary-contact switch (connected to contactor coil) in the selector switch panel or at one of the remote control stations installed in the room. Should control be desired from a speakers rostrum, or a slide projector table, it can be had by using a three-gang, momentary-contact switch block on a nine-conductor, flexible cord connection. All remote control panels are equipped with three-prong, twist-type receptacles for these portable control cords. Single-switch (momentary-contact) control blocks can be used if desired. All circuits, when on "remote" control, are fused at the contactor panel.

When selector switches are on "manual" position, circuits are controlled by the circuit breakers in the lighting panel (Fig. 3) as well as at the selector switch panel. Circuit protection, in this case, is at the circuit breakers in the lighting panel.

Biggest advantages of this system are the selectivity and remote control of specific circuits. Now the room can be used as one large area, or divided by portable screens, or folding partitions and illuminated to fit the specific type of function taking place in each section. Lighting can be remotely controlled at each section. Selector switches must first be set individually on either manual or remote positions according to specific requirements.

Electric Heat Reduces Resin Curing

PRODUCTION

Coating cloth with a synthetic resin, applying an abrasive surface, and curing the resultant fabric has been reduced more than 90% through the installation of strip radiant heaters in the Simonds Abrasive Company plant in Philadelphia. Formerly, cloth web speed was held to ¾-foot per minute. Now speeds are 8 feet a minute.

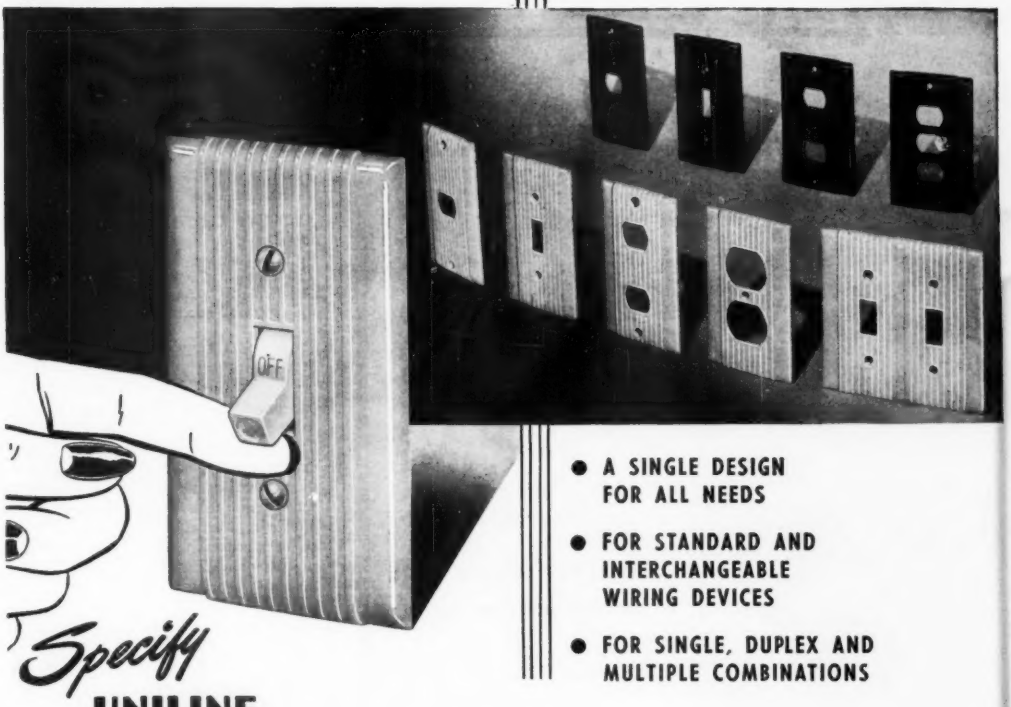
To completely and uniformly heat the 27-inch-wide cloth, 24 heaters rated at 1400 watts and 230 volts were installed; nine on the front, 9 on the rear and 3 on each side to form a hollow rectangle. Units are operated two in

ATTRACTIVE · CLEANLINED · MODERN

New UNILINE
TRADE MARK

WALL PLATE DESIGN *by*

HART H&H HEGEMAN DIVISION



- A SINGLE DESIGN FOR ALL NEEDS
- FOR STANDARD AND INTERCHANGEABLE WIRING DEVICES
- FOR SINGLE, DUPLEX AND MULTIPLE COMBINATIONS

Specify UNILINE
TRADE MARK

FOR COMPLETE ARCHITECTURAL UNIFORMITY

The new UNILINE features the clean, simple appearance demanded by modern design standards. It blends harmoniously with all interiors. Because this one line meets your wall plate needs, architectural uniformity is assured. Specification problems are greatly reduced — especially when UNILINE is used in combination with our complete line of Architectural Specifications Grade Standard and interchangeable wiring devices.

These attractive, easy-to-clean wall plates are available in brown Bakelite and in Ivorylite. The backs are reinforced providing extra strength. ***You need just one line — if it's UNILINE!***

HERE'S IMPORTANT INFORMATION . . .

. . . about the latest developments in home wiring. Here are dozens of new ideas to help you plan really modern electrical convenience that makes more satisfied customers and more new customers. Send today for the fully illustrated booklet, "Electrical Planning In The Home," prepared for you by the Good Housekeeping Building Forum. For your free copy — and for more complete information about UNILINE wall plates and other wiring devices, just write to 1710 Laurel Street, Hartford 6, Conn.

WIRING DEVICES
ENCLOSED SWITCHES

HART H&H HEGEMAN DIVISION

HART & HEGEMAN DIVISION
THE ARROW-HART & HEGEMAN ELECTRIC CO.
HARTFORD 6, CONNECTICUT

BLACKHAWK INDUSTRIES

Fittings and Fixtures

QUALITY YOU CAN DEPEND UPON

for PERFORMANCE

for PROFIT

BLACKHAWK No. 600
Watertite Connectors for Service Entrance Cable

BLACKHAWK No. 3626
Steel Clad Wire Holders

BLACKHAWK No. 514
Porcelain Enamel Yard Lights

IMMEDIATE DELIVERY FROM ADEQUATE STOCKS
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BLACKHAWK INDUSTRIES,
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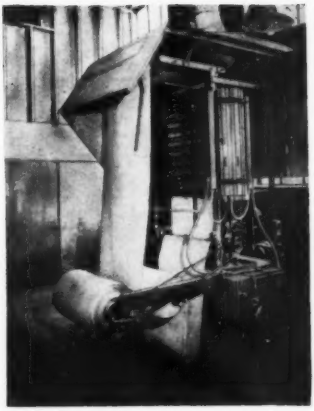
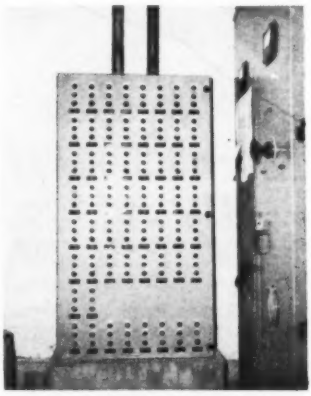
Entrance Cable Fittings • Sill Plates • Staples
Connectors • Box Supports • Cable Straps
Locknuts and Bushings • Wire Holders
Yard Lights • Fluorescent Brackets



ABRASIVE CLOTH passes through rectangular oven consisting of 24 radiant heating elements rated at 1400 watts, 230 volts, at the rate of 8 feet a minute. Volatile gasses are removed from the overhead hood by forced ventilation.

series on 460-volt circuits. Total installed capacity is 33.6-kw.

In operation, rolls of cloth are impregnated with abrasive grit, fed through a dipping tank of resin, pressed between rollers to squeeze out excess fluid, passed between the radiant heating units for curing, then rewound on rolls. Volatile gasses given off during the curing cycle are collected by an overhead hood and removed from the plant by forced ventilation.



REMOTE CONTROL PANEL in engineer's office at General Petroleum Corporation office building in Los Angeles has groups of push buttons with pilot lights. Each of 48 fan rooms comprising the air conditioning plant can be individually controlled from this point. Pilot lights indicate when fans are running; give the engineer an instant picture of the electrical load and areas using air from the twin duct system.

PLANNING AERIAL CIRCUITS?...
CIRCUITS TO BE BURIED DIRECTLY IN EARTH?...
CIRCUITS TO BE INSTALLED IN DUCTS OR CONDUIT?

• Here's one cable for all three services

THAT SAVES and SAVES and SAVES!!

SAVES ON FIRST COST. Simplex-ANHYDREX Cables save you money at the outset for their moisture-resisting Anhydrex insulation and their tough neoprene jacket combine to eliminate the need for costly metallic sheaths or other protective coverings. They save you the expense of buying and stocking a variety of cables for different applications as they are designed for use — as is — in open air, in the earth, and in ducts or conduit. They are Type RR Cables. They have CAA approval as underground cables for airport lighting under Specification L-824. They are suited for use as underground service entrance cables and when requested bear Underwriters' Type USE labels. You'll find them ideal, too, for street and park lighting, as Drive-In-Theatre Cable, and in signal and control circuits.

SAVES ON INSTALLATION. The comparatively light weight and small diameter of ANHYDREX Cables, their flexibility, and their smooth jacket surface result in worthwhile savings on installation. Crews work faster, more efficiently, for they find ANHYDREX Cables easy to handle, easy to splice, joint and terminate. When pulling the cable through ducts no oil or grease lubricants are needed. Marks, letters, or figures may be molded onto the jacket to provide instant identification of circuits.

SAVES ON MAINTENANCE. Simplex-ANHYREX Cables promise long, dependable service, free of untimely failures and costly maintenance. Their Anhydrex insulation has excellent dielectric properties and provides steadfast resistance to water and moisture. The neoprene jacket is resistant to abrasion, soil acids and alkalies, oil, flame, sunlight and weathering. Having no metallic coverings, the cables are not subject to electrolysis nor harmed by vibration, stray or secondary currents.

SIMPLEX-ANHYDREX

SIMPLEX WIRE & CABLE CO.
79 SIDNEY STREET
Cambridge 39, Massachusetts

make

PAINE

your first choice

Expansion Screw Anchors

For more than forty years Paine Fastening and Hanging Devices have been the first choice of the best craftsmen. They have found, through use, that Paine's high quality material and production assure ease and speed of installation. Today and tomorrow make Paine devices *your* first choice.

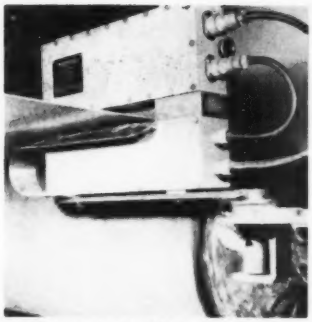
Paine Expansion Screw Anchors will HOLD in any solid material. Anchors are stamped with size and thread of bolt or screw required, and have a directional arrow indicating which end goes in the hole. Setting tool furnished with each box of anchors.

For the holes use a Paine "Sudden Depth" Drill.

THE PAINE COMPANY 2961 Carroll Ave., Chicago 12, Ill.

the best craftsmen always take PAINE'S

Spring Wing Toggle Bolts	Conduit Clamps	Star Drills
Expansion Anchors	Pipe Hooks and Straps	Malleable Shields
"Sudden Depth" Drills	Hanger Iron, perforated	Special Hanging and
Wood Screw Anchors	Expansion Shells	Fastening Devices



BETA-RAY GAGE HEAD, mounted on a 136-inch paper machine, measures deviations from desired weight per unit area of paperboard. Gage controls, indicator and recorder are located near the controls for the processing machinery.

Beta-ray Gage Controls Weight

PRODUCTION

In the production of milk carton paperboard, it is extremely important that the machinery used produce paperboard of uniform weight. Milk carton board, and similar material that is run through folding machines, must have a uniformity of weight which satisfies the very close tolerances on which folding machines operate.

At the Antioch, California, plant of the Fibreboard Products Corporation, weight uniformity of milk carton paperboard is accomplished by beta-ray gaging. In the first installation of its kind, a General Electric beta-ray gage is mounted on one of the company's 136 inch paperboard machines. This unit records the varying amounts of beta-rays absorbed by the board as it passes through the gage head of the non-contacting device. Because the amount of beta-rays absorbed varies with the weight of the board, the gage provides a continuous and automatic indication and record of deviations from a desired weight of material. Variations as slight as 1% are indicated and recorded.

The gage indication enables an operator to make the necessary adjustments of the processing machinery to produce paperboard of uniform weight. And in addition to preventing bad runs, the unit has been found to aid in setting up new runs more quickly.

This beta-ray gage is not affected by the speed, consistency or temperature of the material being measured. It therefore may be applied to plastics, rubber, metals and sheet materials where a continuous indication is desired. Since no part of the gage is in actual contact with the material being measured, it leaves no mark or scratch.

This Showroom Smiles on Both Sides of its Facade...

with Lighting by LITECONTROL

JOB: Emerson Rug Company, Worcester Turnpike, Natick, Mass.
FIXTURES: General Lighting, Litecontrol No. 5938 3-lamp recessed slimline fixtures, with No. 9015 Holophane® Low Brightness Lenses. Show Window, No. R-150 recessed downlites, with 150 watt R-40 reflector spot lamps. Beneath marquee over sidewalk, No. 8FH recessed 150 watt lens boxes, using Holophane No. 748 widespread lenses.
CEILING HEIGHT: 10' - 0".
SPACING: 11' - 0" on centers.
WATTS PER SQ. FOOT: 2.6 (showroom only).
AVERAGE INTENSITY: 50 footcandles in service.
LIGHTING ENGINEER: C. A. Russell, Boston Edison Co.

From the street, this showroom beckons a cheery "Welcome . . . come in!"

Once inside its *Lighting by Litecontrol,* famed for restful non-glare low brightness, says, "Stay, look around, visit in comfort."

A complete job by LITECONTROL from front to back, this installation is another of the many hundreds where *standard* LITECONTROL fixtures encourage sales while saving money.

On your next lighting problem, you'll do well to remember that a LITECONTROL consultation may very well help you do a better job of putting the right fixture in the right place for the right light . . . *for less money.*

LITECONTROL *Fixtures*

KEEP UPKEEP DOWN

LITECONTROL CORPORATION, 36 Pleasant Street, Watertown 72, Massachusetts

DESIGNERS, ENGINEERS AND MANUFACTURERS OF FLUORESCENT LIGHTING EQUIPMENT DISTRIBUTED ONLY THROUGH ACCREDITED WHOLESALERS

YOU* ASKED FOR IT!

....SO

National Electric developed

SURFACEDUCT

"We need a small, all-purpose electrical raceway . . ."

"Low cost . . . Low Maintenance . . ."

"Safe . . . Light . . . Strong"

". . . electrical modernization"

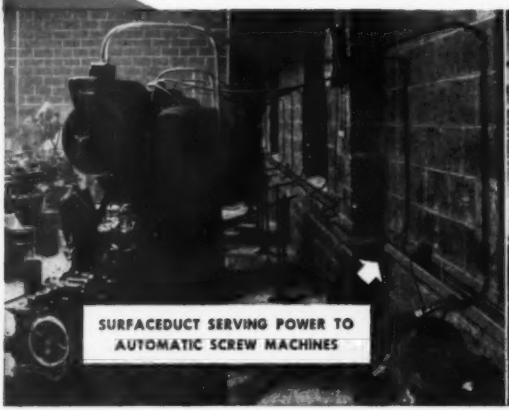
". . . for flexible lighting arrangements"

"No fishing . . . Unobstructed wiring channels"

"Easily installed . . . Completely accessible . . ."

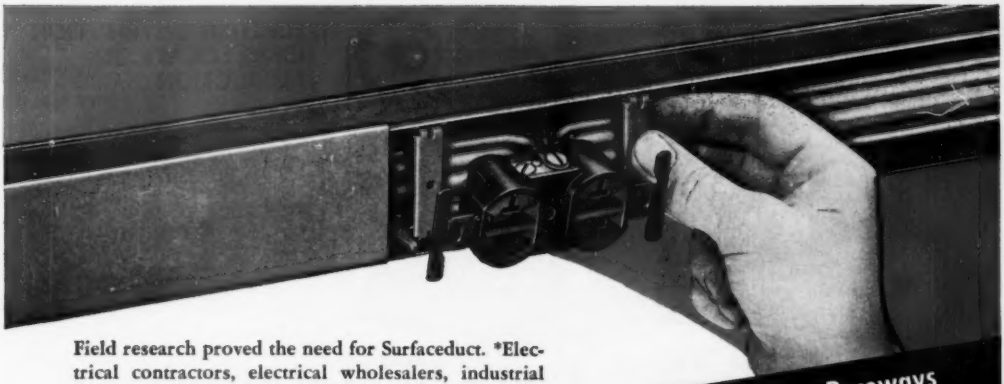
"Easily rerouted . . . Minimum of fittings . . ."

Pioneering is Simply Doing the Obvious FIRST



SURFACEDUCT SERVING POWER TO AUTOMATIC SCREW MACHINES

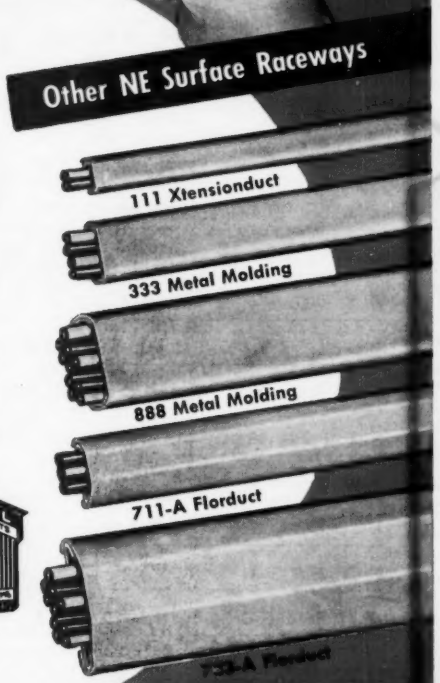
SURFACEDUCT LIGHTING AND POWER APPLICATION



Field research proved the need for Surfaceduct. *Electrical contractors, electrical wholesalers, industrial engineers, plant maintenance men, architects—all told us what they wanted in a general purpose electrical raceway system.

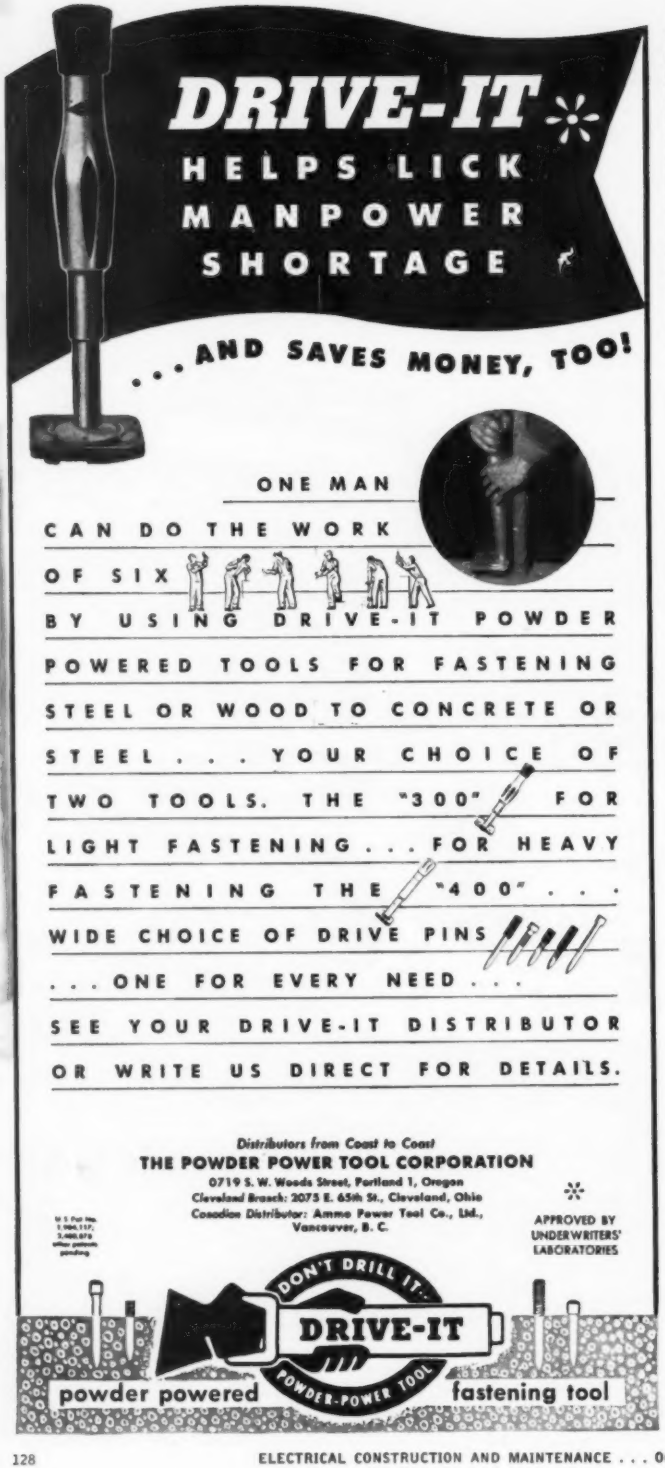
Surfaceduct was designed in strict accordance with the advice and suggestions of these men in the electrical field who were to install or specify it. The engineering "know-how" National Electric had attained as pioneer manufacturer of surface raceways took Surfaceduct from the blueprint stage to production and on to an enthusiastic reception by the electrical trade.

Today, only six short years after its introduction, Surfaceduct is efficiently serving electrical applications requiring light or power up to 60 ampere service. Surfaceduct is another versatile product of National Electric, the world's largest producer of the *complete line* of secondary electrical distribution systems.



EVERYTHING IN WIRING POINTS TO

National Electric
PRODUCTS CORPORATION
1301 CHAMBER OF COMMERCE BUILDING • PITTSBURGH 19, PA.


DRIVE-IT
HELPS LICK
MANPOWER
SHORTAGE
. . . AND SAVES MONEY, TOO!
ONE MAN
CAN DO THE WORK
OF SIX
BY USING DRIVE-IT POWDER
POWERED TOOLS FOR FASTENING
STEEL OR WOOD TO CONCRETE OR
STEEL . . . YOUR CHOICE OF
TWO TOOLS. THE "300" FOR
LIGHT FASTENING . . . FOR HEAVY
FASTENING THE "400" . . .
WIDE CHOICE OF DRIVE PINS
. . . ONE FOR EVERY NEED . . .
SEE YOUR DRIVE-IT DISTRIBUTOR
OR WRITE US DIRECT FOR DETAILS.
Distributors from Coast to Coast
THE POWDER POWER TOOL CORPORATION
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Cleveland Branch: 2075 E. 65th St., Cleveland, Ohio
Canadian Distributor: Ammo Power Tool Co., Ltd.,
Vancouver, B. C.
APPROVED BY
UNDERWRITERS'
LABORATORIES
DON'T DRILL IT...
DRIVE-IT
POWDER-POWER TOOL
powder powered
fastening tool

ELECTRIC DISTRIBUTION IDEAS FOR WELDER PRODUCTION

[FROM PAGE 107]

rows with a 4-foot center-to-center spacing. The office lobby is generally illuminated by recessed incandescent downlights of 75-, 150-, 200- and 300-watt capacities, depending upon position, height of ceiling and decorative features in the vicinity. Since the lobby ceiling is dropped, a bordering cove has been provided to highlight wall surfaces, with coves containing double rows of slimline lamps operating at 300 milliamps.

Structural Pipe Carries Wiring

The forward lip of the canopy in front of the separate entry building is outlined by 100-watt incandescent lamps fitted with half shades; a unique installation feature being the use of the 4-inch structural pipe, along the edge of the canopy, as a wireway for these lighting circuits. Intensities are built up on the pavement before the semi-circular all-glass doorways by canopy-recessed 200-watt incandescent lensed units. The wide descending stairway inside the entry building is illuminated by special aluminum column lights containing 300-watt R-40 lamps.

At the foot of this stairway, the entrance corridor extends to the office lobby, with upper wall lighted by 2-lamp 6-foot slimlines at 300-ma. Frosted glass panels diffuse this light, while vertical fins between fixtures reduce glare along the corridor line. At either end of the corridor, 25 watt T-10 lamps on 7-inch centers extend horizontally from wall receptacles, with ornamental fins between lamps creating an interesting shielding pattern. Corridor fixtures are on two circuits for service continuity in the event of an outage.

Exterior parking, substation, and general protective-lighting is by 500-watt floodlights mounted on roof cornices and building corners.

Lincoln's new plant was planned and constructed as a direct answer to a demand for more, better and less-expensive welding units. For arc welding—already a standard method for industrial fabrication, production, maintenance and service—is also rapidly becoming a popular home-workshop tool and an urgently-needed farm requisite.

Engineered and constructed by The Austin Company, the plant was powered and lighted by The Grant Electric Company.

Fastens steel or wood to concrete or steel in seconds!

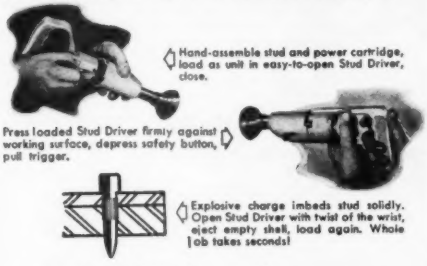
NEW CARTRIDGE-POWERED MODEL 450

REMINGTON STUD DRIVER

Sets fastening studs up to 100 times faster than conventional methods...needs no outside power source

You can speed construction and maintenance fastening jobs and cut costs with the amazing new Remington Stud Driver. This simple tool attaches steel or wood pieces and fittings to concrete or steel . . . easily sets as high as 5 fastening studs in a minute. No outside power source or other equipment needed. It's compact, rugged, *safe*. Test-proved to be the world's finest fastening system, the Model 450 Remington Stud Driver is made by Remington Arms Company, Inc., America's oldest and foremost sporting arms manufacturer. For detailed information and the name of your nearest distributor, fill out and mail the coupon below. There may be slight initial delays on delivery until production and distribution catch up with demand.

How to operate the Model 450 Remington Stud Driver


Hand-assemble stud and power cartridge, load as unit in easy-to-open Stud Driver, close.
Press loaded Stud Driver firmly against working surface, depress safety button, pull trigger.
Explosive charge imbeds stud solidly. Open Stud Driver with twist of the wrist, eject empty shell, load again. Whole job takes seconds!

Speeds all these jobs . . . and many more

1. Hanging steel sash and door bucks to concrete and brick.
2. Anchoring wood plates to concrete floors and ceilings for setting partitions.
3. Fastening wood furring strips to concrete for attachment of metal lath.
4. Anchoring suspended ceilings, sprinkler systems and lighting fixtures to concrete.
5. Attaching conduit and panel boxes to steel and masonry.
6. Anchoring light machinery to concrete pads.
7. Erection of signs, awnings and venetian blinds on steel or masonry.
8. Hanging radiator housings to concrete or brick.

LOOK AT THESE EXCEPTIONAL FEATURES

COMPACT AND PORTABLE — Weighs only 5½ pounds, ideal for scaffold, ladder, overhead work, inaccessible places. Comfortable to use in any position.

SPEED—One man can set up to 5 studs per minute, as much as 100 times faster than other methods. Sets stud at whatever depth is required up to 2¾ inches, depending on material.

ELIMINATES INVESTMENT IN OUTSIDE POWER —Self-powered. Especially useful in isolated places.

TRIPLE SAFE—Plainly visible red dot indicator shows when it's cocked; safety must be depressed before and during squeezing of main trigger; permanently attached safety shield must be compressed against work before Stud Driver will operate. Trigger can't be accidentally tripped. Slight recoil. Low noise level.

WIDE VARIETY OF STUDS are available for every fastening job. Genuine Remington studs are trademarked for user's protection. Pull-out resistance as high as two tons in good concrete, depending on stud used. Cartridges are available in 5 power loads covering practically all fastening needs.

UNIQUE, FAST ASSEMBLY OF STUD AND CARTRIDGE—Tough plastic heel cap permits lightning assembly of any cartridge with any stud, identifies power load, protects head and thread of stud during driving.

PRICE for Model 450 Remington Stud Driver complete in rugged steel carrying case—only $119.50.

MAIL THIS COUPON TODAY FOR FURTHER INFORMATION

Remington Arms Company, Inc.
Industrial Tool Division
938 Barnum Ave., Bridgeport 2, Connecticut

I am interested in obtaining detailed information on the Model 450 Remington Stud Driver.

Name _____

Firm _____

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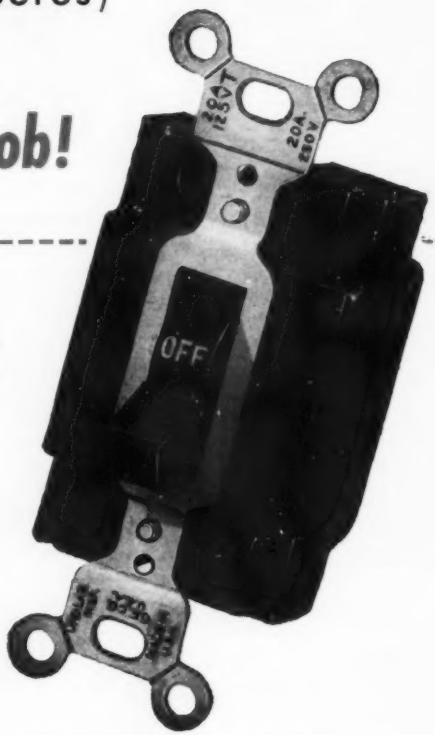
"If It's Remington—It's Right!"

Remington DU PONT

G-E HEAVY-DUTY SWITCHES

(for 20 and 30 amperes)

Built to stay on the job!



Tough construction and smooth action are the double features that make G-E heavy-duty switches important wiring news!

These tough, T-rated switches are protected by an over-all plastic housing. Housing is extra shallow for extra wiring space in boxes. Pressure connectors, designed for convenient back wiring, make installation quick and easy.

General Electric heavy-duty switches are available in single-pole, 3-way, double-pole, and single-pole quadruple break types.

WIRING DEVICES
for home and industry

Try G-E heavy-duty switches at your most troublesome locations. See why they can take abuse in stride. For complete information write Section D65-1018, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

GENERAL ELECTRIC

More Information About NEW PRODUCTS CATALOGS, BULLETINS ADVERTISEMENTS

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Here's how to get manufacturers' information as ***QUICKLY*** as possible.

FOR QUICK ACTION USE THESE CARDS

Describe the product or literature in the space provided. Use trade-names, name-plate data, bulletin numbers and titles, etc. Give the number of the page on which the item is mentioned, and fill in the month of the issue.

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The Editors

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Electrical Construction and Maintenance is written for you by a large staff of editors and consultants, each an authority on some phase of the business. They will be glad to give you expert advice and answers to your questions.

Do you have a problem in wiring layout, motor control, lighting methods, code interpretation? For sound technical advice

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For information on New Products or New Literature—

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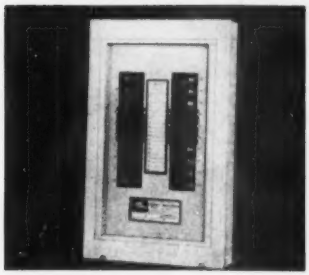
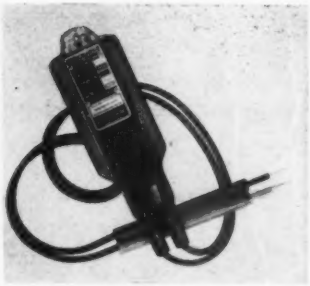
Product News



Load Center (1)

A new load center with a 20 circuit capacity featuring fully magnetic action in each breaker, has been announced. Opposite polarity is provided in each adjacent position by the molded bus construction. It provides any combination from ten 2 pole circuits, 125-250 volts ac to 20 single pole circuits 125 volts ac. The busbar arrangement is of one piece construction, with two busbars (one behind the other) molded into an insulating plastic. Case is finished with baked-on grey Melamine—surface or flush mounting.

Murray Manufacturing Corporation, 1250 Atlantic Ave., Brooklyn 16, N. Y.



Voltage Tester (2)

Announcement has been made of a redesigned model of the Wigginton voltage tester. The main body of the tester is a high dielectric, one piece molded case giving ruggedness and electrical protection even under moist conditions. Case has a slotted receptacle on each side which provides a test mount for either prod. When tester is not in use prods may be inserted in bottom end of receptacle. Prods have four-inch fibre insulators and hardened flat insulated steel points sharpened to pierce insulation. Points can be resharpened. Operating parts are interchangeable with previous Wigginton testers, making service parts available. Voltage range covers 110-220-440-550 volts ac and 125-250-600 volts dc and testers are available for low voltage and 400 cycle systems.

Square D Company, 6060 Rivard St., Detroit 11, Mich.

Motor Starters (3)

New farm motor starters, called Farmstarters, are available for across-the-line starting of single-phase ac motors. They can be supplied in NEMA sizes 1, 1½, and 2, to handle motors from 1 to 7½ hp, 115 or 230 volts. Two different type units are available: with built-in start and stop-reset pushbuttons for local control; and with built-in hand-off-auto selector switch and reset pushbutton for control by an automatic pilot device, such as a thermostat or a pressure switch. Bonderized enclosures and plated metal parts are used. A snap-action, bi-metallic, disc-type overload relay is used. All parts are removable from front of unit, and straight-through wiring is used for ease of installation.

Westinghouse Electric Corporation, Box 2099, Pittsburgh 30, Pa.

Insulating Material (4)

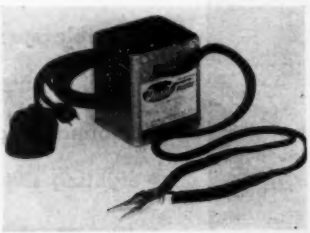
A new fibrous insulating material which will not blister or wrinkle when covered with hot sealing compounds has been developed. Produced especially for use as an insulating liner inside completely sealed electrical components, the new material, Duroid 705, features high dielectric strength and is supplied in sheet or fabricated form.

Rogers Corporation, Manchester, Conn.

Ballast (5)

A new series sequence ballast has been announced. Based on an entirely new concept of ballast design, it insures positive starting on line voltages as low as 106 volts with no detrimental effect to lamp life. Variations in line voltages have no noticeable effect on lamp brilliancy. Size of case is 13-3/16 by 3½ by 2⅝ in. This 425 ma ballast is ETL and UL approved. It is designed to meet every requirement of the new ASA test specification C82.1 for fluorescent lamp ballasts.

Jefferson Electric Company, Bellwood, Ill.

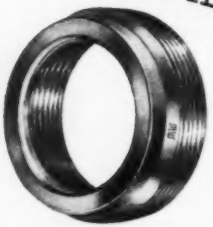


Soldering Pliers (6)

New soldering pliers designed to speed wiring assemblies on the production line features instant heating of connection by means of low-voltage current through plier tips. Use of pliers allows worker to hold parts to be soldered and heat in one operation. They are made of aluminum alloy, and only the portion of work between the tips is heated. Four screws in lid of unit allow it to be mounted under a bench. Current is turned on by means of a non-locking foot switch. Transformer of heavy duty rating delivers one volt from secondary when hooked to standard 120 volt, 50-60 cycle power source. Maximum line current is 3.5 amps, average line current for soldering operation is 2.5 amps.

St. John Engineering Co., 4131 Lankershim Blvd., North Hollywood, Calif.

STAR IN THE FIELD..... midwest



MODERN FITTINGS FOR

- thinwall conduit
- rigid conduit
- metallic and non-metallic cable
- flexible steel conduit
- service entrance cable
- grounding devices
- lighting fixture fittings

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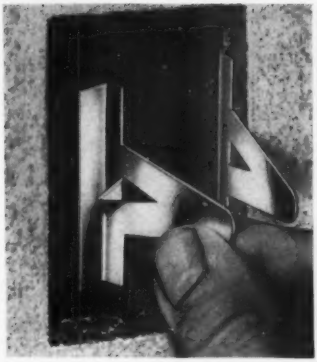


Switchbox Metal Brackets (7)

Metal brackets for holding switchbox to plaster board, plywood or to other materials where screws or nails are impractical, have been announced. Two brackets are sufficient to secure most switch boxes. Device is constructed of aluminum and consists of a small angle piece 2 inches long, $\frac{3}{8}$ inch wide and 3/16 inch high from which extends a triangular lip $1\frac{1}{4}$ inches by 1 inch. Extending at right angles to this lip is a small sharp prong 7/16 inch long. It is this prong which gives the bracket its gripping contact. Brackets may be attached anywhere along the opening.

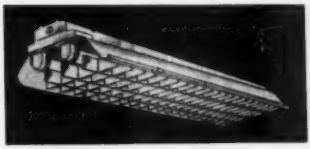
Hilco Engineering Company, Genoa City, Wis.

Bearing (8)

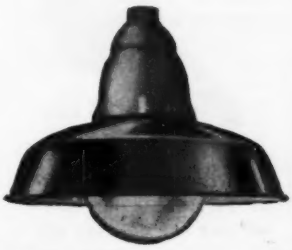
Announcement has been made of the development of a new Nylined bearing. A typical Nylined bearing consists of an outer sleeve of inexpensive metal and a relatively thin lining of Nylon bearing material. The Nylon liner is retained in the outer sleeve in a manner which will permit it to expand and contract circumferentially around the inner periphery of the outer sleeve. Liner is provided with a narrow slot, or compensation gap, which interrupts the circumference. In applications where lubricants can be used, one or more annular grooves are provided on the inside of the outer sleeve to form storage wells for grease or other lubricants which are evenly distributed through the compensation gap. Nylined principle eliminates the need for wide clearances. They can be furnished in the plain sleeve type or the flange type.

Thomson Industries, Inc., Manhasset, Long Island, N. Y.

(9)



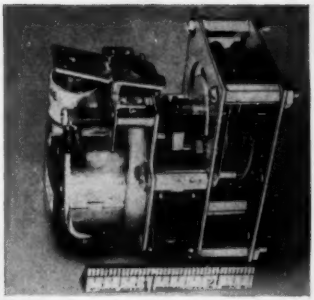
FLUORESCENT FIXTURE, known as Wyte-Liners, has been introduced for production lighting. They are all white, inside and outside. White reflector surface is of 300° Permalux or porcelain enamel. Units are available in 2 and 3 conventional 40 watt light units, for 4 and 8 foot slimline lamps and in 4 and 8 ft. lengths. Manufactured by Edwin F. Guth Company, 2615 Washington Avenue, St. Louis 3, Mo.



Lighting Fixture (10)

A new line of Type DL dust tight lighting fixtures has been announced. They are designed to provide illumination for hazardous locations where flammable or explosive dusts are present—specifically Class II. Groups E, F, G, and Class III. Two exclusive design features are: (1) Lampholders are located within conduit box assembly of both pendant and junction box types, permitting installation and wiring without regard to size or style of fixture. (2) All fixture-globe-reflector assemblies fit either base and are attached or interchanged by means of a bayonet slot and screw arrangement, without disturbing electrical connections. They accommodate any style fixture-globe-reflector assembly in either 100 watt or 200 watt sizes, providing interchangeability.

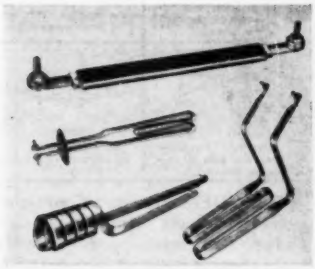
Russell & Stoll Company, Inc., 125 Barclay Street, New York 7, N. Y.



Relay (11)

Announcement has been made of a new delayed reset time delay relay. Unit incorporates the basic 5400 series dc and 11400 series ac time delay relay. It makes possible a delayed reset proportional to the time delay and a circuit reclosure time proportional to the length of current interruption. Relay is suited for application as a vacuum tube protective system. It assures the desired delay in feeding high voltage to the plate circuit, holding back the load until the cathodes have reached proper temperature.

A. W. Haydon Company, Waterbury, Conn.



Electric Heating Element (12)

A new flat, sheathed electric heating element, for industrial heating such as is used with kettles, tanks, ovens, dies, driers and for immersion in liquids, has been announced. Unit provides flat surfaces for contact heating and a thin section for convection and air flow. It is a rugged structure, readily bent and formed, and is resistant to moisture and vibration. They can be applied with self-regulating characteristics where their wattage will vary inversely with the heater temperature. A variety of terminals are available or the heaters may be brazed or welded into various fittings or provided with holddown straps or brackets.

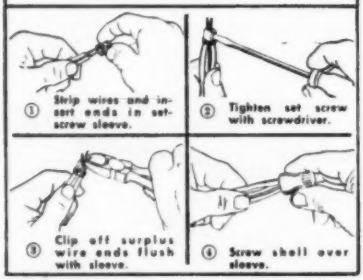
Syntron Company, 690 Lexington Avenue, Home City, Pa.

Make Stronger, Safer Pigtail Splices!

THE NEW IDEAL SET SCREW WIRE CONNECTOR

PERMITS VISUAL INSPECTION OF JOINTS AT ANY TIME

...Easy to Use...Safe


① Strip wires and insert ends in set-screw sleeve.
② Tighten set screw with screwdriver.
③ Clip off surplus wire ends flush with sleeve.
④ Screw shell over sleeve.

Approved FOR 600 VOLTS AS PRESSURE CABLE CONNECTORS FOR GENERAL USE

● With IDEAL Set-Screw Connectors you can make perfectly insulated, *super-safe* splices in branch circuit wiring, fixture hanging, machine and appliance hook-up—in just a few seconds per splice! They let you make changes in circuit layouts easily—just unscrew and re-use the same connectors! Or inspect joints at *any* time! Extra-long, extra-strong—IDEAL Set Screw Connectors offer you a new high safety factor that eliminates chance of flash-overs at higher voltages and insures against service failures. They are corrosion-resistant—shake-proof—pull-proof—built to be safe for a lifetime by IDEAL, for 27 years the contractor's first choice for precision-built, top-performance wire connectors. Try IDEAL Set-Screw Connectors on your very next job!

IDEAL FREE SAMPLE

IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Illinois

Please send us free samples and catalog information on the new IDEAL Set-Screw Connector.

NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE___ STATE_____

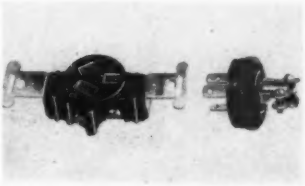
Two sizes, listed by Underwriters' Laboratories, Inc. for all common wire combinations

Sold Through America's Leading Distributors

Dowser Ball **(13)**

Announcement has been made of a Dowser ball which measures the "give" in plaster or wall board. It will indicate little or no "give" when used on wall supported by a stud. This area is called a "dead area". To find a stud, test the wall for a "dead area". When the Dowser is held against the wall and the wall is struck a light blow with the fist, the small Dowser ball will move the least when the Dowser is held over a supporting wall member such as a wood stud.

Ford Product, P. O. Box 282, Tuckahoe 7, N. Y.



Polarized Receptacle **(14)**

Announcement has been made of three-wire polarized flush receptacle and cap of black Bakelite rated at 15 amp, 125 volt; 10 amp, 250 volt. Receptacle is of one piece Bakelite; double contacts; three terminal screws; underslung steel strap. Caps have solid brass blades, three large terminal screws. The line is known as 5000 Series.

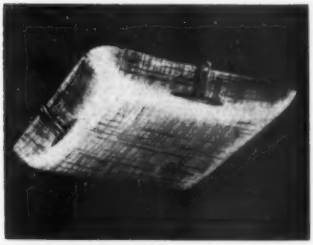
Leviton Manufacturing Company, 236 Greenpoint Ave., Brooklyn 22, N. Y.

Insulation **(15)**

Announcement has been made of "Quinterra Type 3", an asbestos-base, silicone-treated, high temperature electrical insulation. It is a Class H insulation, as defined by AIEE standards, for service at a temperature of 180 C. It is used for both inter-layer

and wire wrapping insulation and adaptable to a wide range of electrical devices including air cooled, inert gas, and silicone filled transformers. It maintains a dielectric strength of 350 VPM under continuous exposure to Class H maximum temperature of 180 C. Quinterra Type 3 is supplied in sheets, rolls and tapes. Widths can vary from ¼ inch to 36 inches and will be factory cut to specification. Available thicknesses are from 3 to 9 mils. It may be used alone or combined with other dielectric materials such as mica or glass cloth.

Johns-Manville, 22 East 40th Street, New York 16, N. Y.



Ceiling Fixtures (16)

A new group of 15 ceiling fixtures, additions to the Universal Pacemaker collection, has been introduced. Styled to suit current fashion trends in traditional, provincial and modern homes, the "flat-to-the-ceiling" fixtures offer new finishes, new colors, new clasps. Many are engineered to provide three-way light and dramatic lighting effects. With the "Colouvered" lens, fixtures offer a choice of soft over-all lighting, dramatic downlight on a single object and a combination of the two. All offer simplified mounting installation through clasps at edges of the glass and the elimination of center button.

Lightolier, Inc., 11 East 36th Street, New York, N. Y.

Incandescent Lamp (17)

Introduction of a 60-watt incandescent "white" lamp has been announced. It contains an inside "Q" coating that spreads the light evenly over the entire surface of the bulb. The new coating is composed of a silicon compound that gives near-perfect diffusion. Benefits of lamps with the new coating are that they cast soft shadows, lessen reflected glare, diffuse the light evenly, and have a white, clean appearance.

General Electric Company, Nela Park, Cleveland 12, Ohio

Let IDEAL Tools Save Time and Cut Costs on Every Wiring Job..

FISH TAPE, REEL AND PULLER (Patented No. 1,890,945)

3 tools in 1—

Cuts Fishing Time in Half!

Even long conduit runs are easy to handle when you have the BIG, sure pull afforded by an IDEAL Reel and Puller. Tape is always under safe control—in the conduit or locked in the Reel—easy to reel in or pay out—can't kink or spring loose. Complete with tape of finest flat spring steel, oil tempered. Five stock sizes and lengths —50' to 200'.

FLUR-TEST

Fluorescent Fixture Tester

Shows Source of Trouble, Right at the Fixture!

Saves time and effort in testing fluorescents. Shows in just a few seconds, right at the fixture whether failure is in the fixture circuit, the tube or the starter. Prevents needless discard of good tubes. Models for 15-40 and 85-100 watt fixtures with exposed starter or with adapter for starter behind tube.

"E-Z" Wire Stripper

Strips Clean, Strips Fast and Saves on *Wire!*

The rugged, all-steel stripper that has been a stand-by of electricians for years to speed up and simplify stripping of stranded or solid wire. Easy to use as pliers. Automatic stop positively prevents crushing of stranded wire. V-notches on blades save wire by eliminating accidental scoring or cutting of wire. Portion of hardened, replaceable blade also serves as a wire cutter. Six sizes handle all wire gauges from 8 to 30.

Wire Pulling LUBRICANT

Provides a film of lubricant that speeds up wire pulling and protects insulation against strains and breaks. Makes it easier to add wires to conduit already containing wires or to remove wire from conduit. Non-corrosive, non-combustible and non-injurious to hands or clothes. For lead or plastic covered wire or cable. (Not for asbestos covered wire.) Quarts or gallons.

IDEAL WIRING TOOLS ARE SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS

IDEAL FREE CATALOG DATA

IDEAL INDUSTRIES, Inc.
1041 Park Avenue, Sycamore, Illinois

Please send catalog data on:

- ☐ Fish Tape, Reel and Puller
- ☐ "E-Z" Stripper
- ☐ Wire Pulling Lubricant
- ☐ FLUR-TEST

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COMPANY_____

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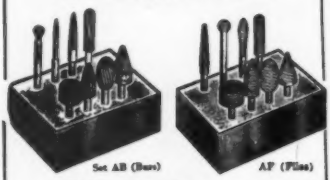
MARTINDALE

MOTOR DRIVEN FLEXIBLE SHAFT GRINDERS

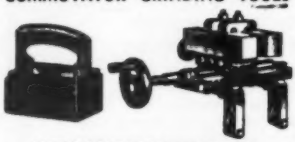
ROTARY BURS AND FILES



Set AB (Burs) AF (Files)

BLOWERS AND VACUUM CLEANERS

MARTINDALE COMMSTONES AND COMMUTATOR GRINDING TOOLS



MICA UNDERCUTTERS FOR SLOTTING COMMUTATORS.

Nine Motor Driven Types

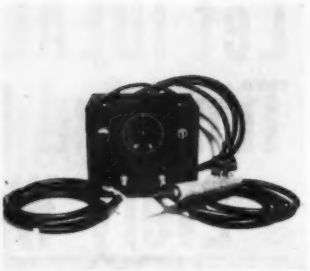
MARTINDALE PROTECTIVE MASKS

Weigh less than ½ ounce.

Write for 64-page Catalog describing these and many other products for Industrial Maintenance, Safety and Production.

MARTINDALE ELECTRIC CO.

1309 Hird Ave. Cleveland 7, Ohio



Soldering Unit (18)

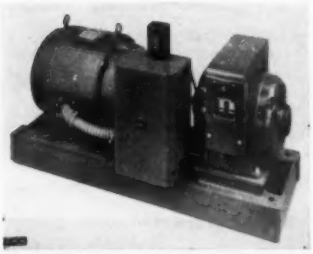
Announcement has been made of a resistance type soldering tool, which is useful for small or large industrial plants. Features are: 5 ft. extra flexible cables, instant heat, no open flames, low current consumption. Metal cases are finished in marine gray ripple enamel. Electrode holders are made of acid resistant plastic and have interchangeable 5/16 in. electrodes. They are available in 110 volts, 60 cycle "standard" and "heavy duty" units, complete with electrodes.

Sunrise Products Company, P. O. Box 173, *Hawthorne* 1, *N. J.*

Regulators (19)

Features of the new Subway Type "CMH" constant current regulator are lighter weight, higher efficiency, smaller size, and extra ruggedness. The oil-cooled regulators are automatically controlled units which can operate, if necessary, submerged in water. Internal cable connections simplify installation, and maximum accessibility is provided by locating terminals above the oil level. Regulators, which conform to EEI and NEMA standards, are available in ratings of 3, 5, 7½, 10, 15, 20, 25 and 30 kw, with primary voltages of 2400 or 4800, and secondary currents of 6.6 or 20 amps at 60 cycles.

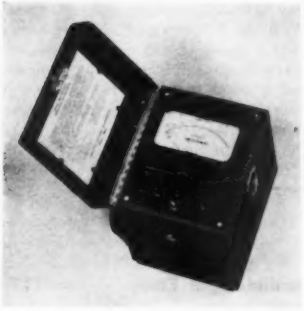
Westinghouse Electric Corporation, Box 2099, *Pittsburgh* 30.



Motor Generator Set (20)

This new mono-coil high frequency motor generator set is used to convert 60 cycle current to 180 cycle and 360 cycle frequencies. Sets are self-exciting and have built-in voltage regulation which automatically compensates for fluctuations in voltage to the load. This equipment finds its greatest use in plants using high-cycle automatic electric hand tools such as grinders and buffers. Unit shown is 6 kw, 360 cycles, 3600 rpm. Other ratings and speeds are available.

Electric Machinery Mfg. Company, Minneapolis 13, *Minn.*



Insulation Tester (21)

Announcement has been made of Vibrotest, Model 264, which is a new insulation resistance tester with a testing range from 0-100 megohms at 500 volts dc; plus a low-range 0-10,000 ohm scale. The 100-megohm scale (2 megohms center scale) provides range for charting of insulation resistance to show up deteriorating or faulty insulation before it reaches a minimum resistance value consistent with operat-

Century

Serves the Electric Motor User in Two Important Ways:

1. Century motors are designed and constructed for a long, dependable operating life.

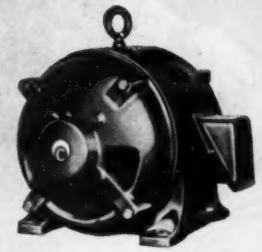
2. Just as important—they are skillfully selected to match the operating characteristics of the many kinds of equipment they drive.

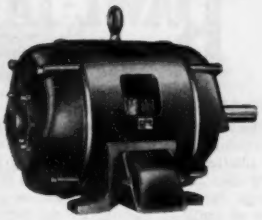
IN CENTURY'S wide range of types and sizes (up to 400 H.P.) there are available: 4 standard classes of starting torque characteristics—6 methods of speed control—constant and short time ratings—4 basic classes of frame protection against atmospheric hazards—a dozen methods of mounting the motor to the equipment—plus many special specifications to meet the requirements of the BIG NAME equipment manufacturers who use Century motors as a component part of their equipment.

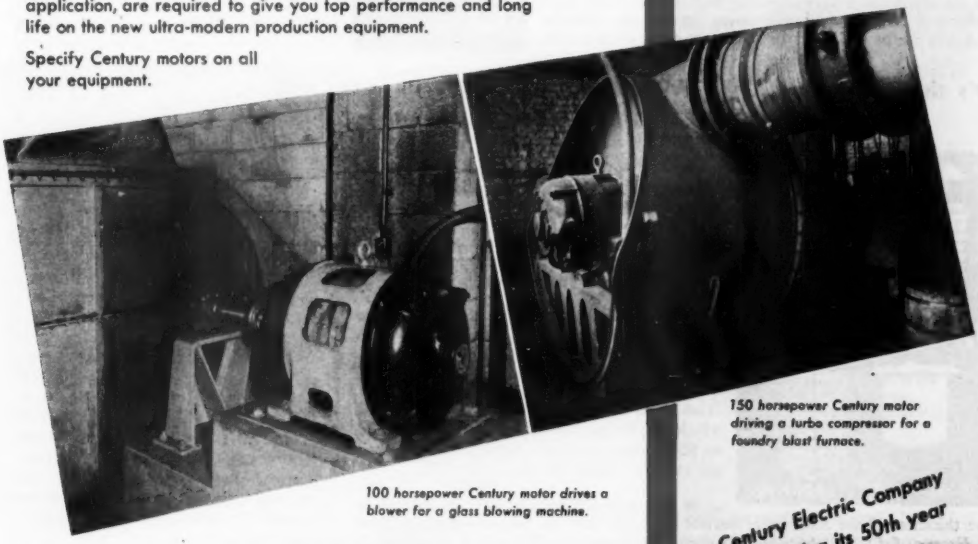
Teamwork with equipment producers gives you skillfully selected motors from Century's wide range of types and sizes . . . properly applied to match the performance characteristics of the machines they drive.

Both a properly designed and constructed motor, plus skillful application, are required to give you top performance and long life on the new ultra-modern production equipment.

Specify Century motors on all your equipment.







100 horsepower Century motor drives a blower for a glass blowing machine.

150 horsepower Century motor driving a turbo compressor for a foundry blast furnace.

Century SERVICE Is Near Any CENTURY Motor Driven Equipment

Prompt Service is offered by CENTURY'S National Network of more than 200 Authorized Service Stations, supervised by 28 Century Sales offices.

1. Facilities for immediate exchange of most CENTURY standard ratings of standard construction are available at CENTURY Authorized Service Stations.
2. CENTURY Authorized Service Stations are qualified and equipped to service and repair any piece of CENTURY apparatus.
3. Genuine CENTURY renewal parts are available at CENTURY Service Stations, CENTURY Parts Distributors and at the factory in St. Louis.

704

Century Electric Company is celebrating its 50th year in the electrical industry

CENTURY ELECTRIC CO.

1806 Pine St. • St. Louis 3, Missouri

Offices and Stock Points in Principal Cities

Century C MOTORS

When Worn Drills and Under-Size Holes Add to Your Anchoring Problems...

Go on using that Worn Drill!

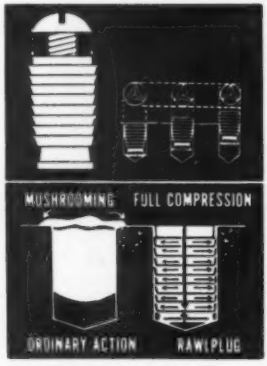
— Yes, you can continue to use that very drill for the rest of its natural life, even when the holes drilled become alarmingly smaller than expected because of any change in dimension as the drill wears down.

RAWL-TAPERS

The RAWL-TAPER is a caulked lead machine screw anchor comprised of a lead sleeve with a series of progressively diminishing tapers. The base of the sleeve becoming gradually smaller than the top permits the RAWL-TAPER easy entry into such under-size holes as long as they are large enough for the hard conical nut to enter. The distributed force of caulking throughout the entire length of the lead sleeve is accomplished through the partial collapse of each of the diminishing tapers, causing them to fold under each other and maintain full compression between the threaded nut and the masonry for the maximum in holding power.

It's the TAPER in RAWL-TAPERS that does it!

Remember... RAWL-TAPERS were Designed...



...to meet any variation in the diameter of the hole caused by changes in dimension of the drill as it wears down, *thus saving the cost of new drills.*

...to insure a uniform expansion of the lead for the length of the nut... supplying maximum area in engagement with the masonry.

...to overcome the tendency of *lead* to cling to the surface of the hole and mushroom, which builds up resistance and limits the depth of caulking between the nut and masonry.

...to avoid increasing the diameter of the lead which would require a larger diameter hole and in turn would reach the minimum limit when too small to receive the nut.

...to eliminate the poor practice of increasing the thickness of the lead sleeve beyond a certain ratio in proportion to the base diameter of the nut, which would be drawn up through the lead as soon as the anchor received any strains beyond the normal elastic limit of the lead.

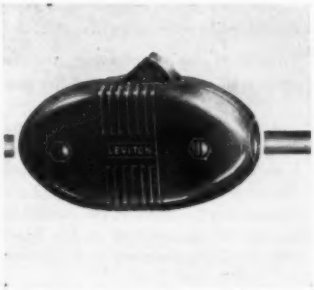
For further information write Dept. E 12-1-2

THE RAWLPLUG COMPANY, INC.
271 CHURCH STREET • NEW YORK 13, N. Y.

THERE ARE RAWL... EXPANSION BOLTS, SCREW ANCHORS AND MASONRY DRILLS FOR EVERY NEED
SOLD THROUGH ALL LEADING HARDWARE, ELECTRICAL AND MILL SUPPLY HOUSES

ing safety. Addition of the 0-10,000 ohm scale makes possible circuit continuity testing with the same instrument. Only two binding posts are used for all tests. Unit is self-contained, with standard battery power source.

Associated Research, Inc., 3752 W. Belmont Ave., Chicago 18, Ill.



Single Pole Switch (22)

Heavy duty, feed-through switch is available in brown Bakelite or ivory. Rated at 10 amps, 125 volts; 5 amps, 250 volts. They have double wiping contacts. Groove for through-lead and terminals on same half for easy wiring. Toggle is of rocker type for thumb control. Cord hole is ¼ inch diameter.

Leviton Manufacturing Company, 236 Greenpoint Ave., Brooklyn 22, N. Y.

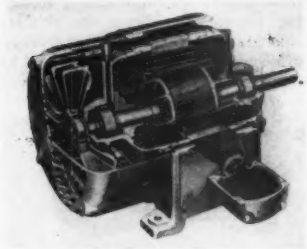
Filter (23)

Announcement has been made of a new type power line filter, Tobe 1457-1, capable of passing 100 amps and having high attenuation in the VHF, UHF and Radar frequencies. Filter extends only 10-3/16 inches overall length with a diameter of ¾ of an inch. It can be inserted in 110, 220 or 440 volts ac or dc line for applications such as screenrooms, radar equipment, radio transmitters, diathermy equipment, x-ray machines, high frequency television transmitters and similar high frequency equipment.

Tobe Deutschmann Corporation, Norwood, Mass.

Explosion-Proof Motor (24)

A totally-enclosed motor for explosion-proof requirements has been developed. Made in capacities from 3 to 75 hp, Types SE and SES, carry Underwriter's label in Class I, Group D, for highly inflammable gases and volatile liquids, and in Class II, Groups F



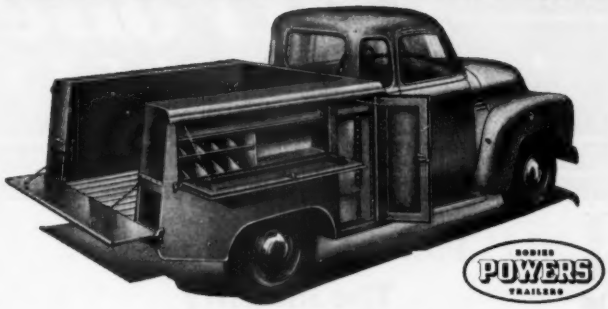
and G, for combustible dusts. Other types SD and SS without label, for non-explosion-proof services, are also available. Features include: sealed terminal, elongated spark-arresting bearing sleeves, hi-draft ventilation, removable cover, split hub fan, normalized castings, lubri-flush bearings, asbestos-protected windings, and solid, centricast rotor. Being completely sealed, motor gives protection against external hazards, preventing intrusion of abrasives, acids, moisture and other deleterious substances.

U. S. Electrical Motors, Inc., 200 East Slauson Ave., Los Angeles, 54, Calif.

Instrument (25)

Announcement has been made of the new Multi-Amp, an instrument for testing and calibrating current actuated devices, such as overload relays for any ac motor, circuit breakers, current transformers, instruments and relays. When plugged into a convenience outlet, it supplies any current from 0 to 500 amps to the device connected to the output terminals. This current can be adjusted in stepless increments with the finger-tip control knob on the front of the cabinet. Furnished for either 110 or 22 volts, 60 cycle, ac input, it draws approximately 10 amperes from the line when supplying its rated output of 500 amperes. Maximum output of approximately 1200 amperes may be used for short periods of time. Current

ARE YOU LOSING $319.37 PER YEAR



or do you have a

Service-Master

"the electrician's service body?"

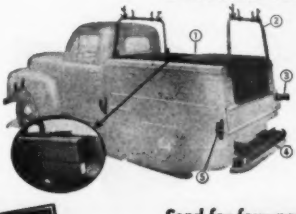
With your present truck you probably spend 15 minutes a day looking for parts or returning to your shop. If your service charge is $3.50 per hour, you lose $319.37 yearly.
Service-Master saves this unproductive time by taking a complete workshop to *every* job. Parts are easy to find—in weathertight compartments which can be locked to prevent theft. What's more, there's plenty of room for bulky items in the larger-than-a-pick-up cargo space. Get further details, today—just mail the coupon below.

Available for immediate delivery in all 48 states

Look at all the features you get in a POWERS Service-Master:

Fully enclosed wheelhousings protect underside of compartments and strengthen side panels; one-piece, ribbed-steel floor distributes weight evenly and prevents sagging at any point; all-steel body shell is electrically welded to form one complete unit; can be mounted on new or used chassis and easily transferred from one unit to another.

OPTIONAL EQUIPMENT



1. Removable overhead rack.
2. Telescopic roof and end-gate enclosure.
3. Removable vise bracket with pipe support.
4. Rear bumper with safety-tread step.
5. Side-mounted pipe carrying brackets.

Send for four-page descriptive bulletin!

McCABE-POWERS AUTO BODY CO.
5900 NORTH BROADWAY • ST. LOUIS 15, MISSOURI

Please send me literature and further information about Service-Master

Name _____ Title _____

Company _____

Address _____

City _____ Zone ____ State _____

567

FULLMAN Latrobe PRODUCTS

FLOOR BOXES ★ WIRING SPECIALTIES

Preferred Throughout The Industry

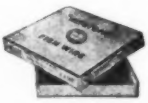
Because of their high quality, ready adaptability, ease of installation and sure performance "Latrobe" Products have won widespread approval for all industrial, commercial and residential jobs.

NO. 252-R Two Gang Box

This Two Gang Adjustable Box has our own No. 208 Receptacle in one section. Has minimum of parts with maximum of efficiency. ½" Flush Brass Plug with one Cover Plate. 2" Flush Brass Plug with other.

Double Duplex Receptacle Nozzle

With ½" brass pipe extension. Neatest and most compact Double Duplex Nozzle on the market. Can also be furnished with ¾" pipe extension if required.



Keystone Fish Wire

Made of finest grade flat steel wire properly tempered to give the desired stiffness and springiness. 10 sizes in 100, 150 and 200 ft. coils.

"Bull Dog" Cable Staples

Favorites in every section of the United States. "Bull Dog" high quality staples can be ordered in cartons, kegs or barrels: 2500, 5,000, 10,000.

"Bull Dog" Insulator Supports

Famous "Bull Dog" Supports can be completely trusted for fastening porcelain or grass insulators to exposed steel framework. Four sizes, from ¼" to 2⅛".

Pipe or Conduit Hanger

Made of highest grade malleable iron this sure grip Bull Dog hanger is economical and dependable. Hangs pipe or conduit ½", ¾", and 1" to steel beams ⅝" thick.

Sold Only Through Wholesalers

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

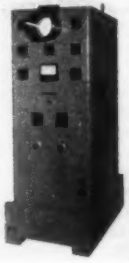
transformers are calibrated by supplying current directly to the primary side. Model 1002 has a built-in 4-range, 4 inch ammeter accurate to 1% on all ranges; 25-50-250-500 amperes.

Multi-Amp Corporation, 121 *Cross* Street, Harrison, N. J.

Lighting Fixtures (26)

A new collection of six sculpted Petrastone ceiling fixtures, which give chandelier effect close to the ceiling, has been introduced. They are particularly adapted to low-ceilinged modern housing. Fixture is white and may be painted either a harmonizing or contrasting color. Made of Petrastone, a new material developed, they are built, like reinforced concrete, around a wire base, and further strengthened with the addition of special binding fibers. Two types of fixtures are offered in each of three styles: one with and one without the "Colouvered" lens. The three styles measure 26½ inches, 5½ inches deep with lens, 6½ inches without; 22½ inches square, 5½ inches deep with lens, 6½ inches without; and 25½ inches in diameter, 5½ inches deep in less style, 8½ inches with button.

Lightolier, Inc., 11 *East 36th Street, New York, N. Y.*



Insulation Tester (27)

A new dc winding-insulation tester for dc armatures, series field coils, and low-impedance ac stator coils, has been

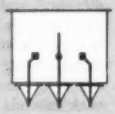
Here's your New Catalog of G&W TYPE "RA" LOAD BREAK OIL SWITCHES

- • • With complete information and design details of many forms of these versatile sectionalizing devices.
- • • An important reference for all men concerned with primary distribution systems.

Here are a few of the many forms of "RA" switches widely used for rapid and convenient isolation and rerouting of cable circuits.

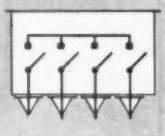
Type "RAD" Single throw

Type "RA" Double throw



Type "RAL" for tapping a looped-thru feeder

Type "RAM" Multiple circuit load break oil switch



See your copy of new bulletin DB51 for the complete story—How "RA" switches are "custom built" from standard unit parts to perform simple or complex sectionalizing jobs.

Since their introduction in 1928, Type "RA" load break switches have had a trouble-free operating record—in utility systems and in industrial plants—which fully justifies their use as load break disconnects for single and multiple circuits.

Included in Bulletin DB51 are listings of standard 400 ampere switches in 7,500 15,000 and 23,000 volt ratings—and 600 volt switches rated 400 and 1,000 amperes. 34,500 volt switches are also available.

SEND FOR YOUR COPY OF NEW BULLETIN DB51 TODAY—

—and plan to obtain distribution system flexibility with G & W Type "RA" load break oil switches.

G&W ELECTRIC SPECIALTY COMPANY
7780 Dante Avenue Chicago 19, Illinois

Please send G & W Bulletin DB51 to:

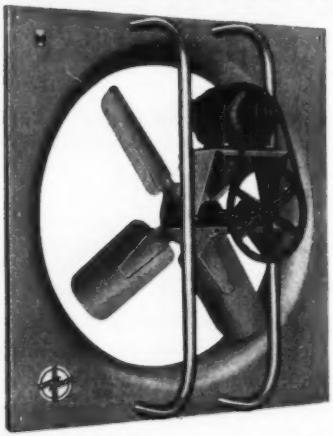
Name_____ Title_____

Company_____

Address_____

City_____ State_____

Remove Dusty and Humid Air with Peerless Electric INDUSTRIAL EXHAUST FANS



PEERLESS ELECTRIC PVB exhaust fans are widely used in factories, warehouses, foundries, etc., and may also be installed in ducts where low static pressure resistance is encountered. Because of complete ball bearing construction, the fans may be mounted in either vertical or horizontal positions.

FIVE FAN SIZES

The fans are made in 24", 30", 36", 42" and 48" diameters. Self-aligning ball-bearing pillow blocks provide rigid support. Bearings are pre-lubricated and equipped with labyrinth steel seals to retain the lubricant and to exclude dust and moisture.

MOTORS

The motors range from ¼ to 1½ H. P., single-phase Capacitor-Induction and three-phase Induction types, are equipped with ball bearings and are totally enclosed, rigid mounted, and operate at 1750 RPM on 60-cycle current. Motors with other characteristics also available.

AUTOMATIC WALL SHUTTERS

Automatic wall shutters of same sizes as fan diameters also are available.

Write for complete specifications on Peerless Electric PVB Industrial Exhaust Fans and Automatic Wall Shutters.

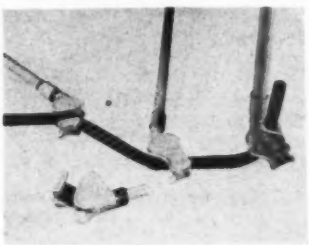
THE PEERLESS ELECTRIC COMPANY

Established 1893 • ***WARREN, OHIO***

Peerless Electric
MOTORS • FANS • BLOWERS

announced. It will detect and aid in locating faults in turn-to-turn, coil-to-coil, and winding-to-ground insulation in dc armatures of any size and rating. It is designed for testing large motors and generators. Tester consists of a repeating type, surge-voltage generator which operates 60 times a second and a cathode-ray oscilloscope, all in one cabinet. A fixture is provided for applying test voltage to the commutator of the armature being tested. It is 20 in. wide, 30 in. deep, 48 in. high. It operates on a power supply of 230 volts, 60 cycles, and is three-wire, single-phase fused for 30 amperes.

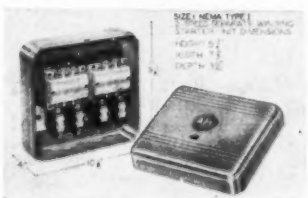
General Electric Company, Schenectady 5, N. Y.



Bending Tool (28)

Announcement has been made of a new bending tool, which can be used in six different directions. The 6-way hickey with its six no slip bending jaws, makes it an ideal tool for making bends, elbows, sets, offsets, loops, saddles and stubs on open or slab work and in close quarters. The stub hole is a new feature devised for bending or straightening conduit protruding from concrete floors or walls. The safety neck extends into the pipe handle.

Tal Bender, Inc., Milwaukee 2, Wis.

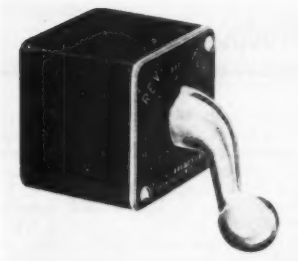


Motor Starters (29)

Two new motors, designated Types "RAR" and "RAS", have been announced. "RAR" (reversing) and "RAS" (multi-speed) feature the "right angle" operating mechanism. Other features are: reduced size and

weight with increased operating efficiency, straight-thru front wiring, and protection of electromotive equipment. They are supplied in sizes 0, 1, 2, 3 and 4. NEMA Type I steel housings are available for all round indoor use; NEMA housing Types IV, VII and IX are also supplied adapting the "RAR" and "RAS" to use in most of the exposed and hazardous locations usually encountered in industry.

Arrow-Hart & Hegeman Electric Co., 103 Hawthorn St., Hartford 6, Conn.



Reversing Drum Switch (30)

Announcement has been made of a new reversing drum switch, Bulletin 350 Style A, suitable for a wide variety of mounting arrangements for small workshops and industrial services. It is the equivalent of a three pole double throw switch. Designed for machines and equipment requiring an across-the-line starting and reversing switch for ac and dc motors rated at two hp or less. Housing contains eight fixed contacts, a moving contact assembly, handle-coverplate assembly, and mounting screws. Contacts are cadmium silver alloy. Wide flexibility in mounting is provided.

Allen-Bradley Company, Milwaukee, Wis.

Portable Drying Unit (31)

Announcement has been made of a new Durabake portable drying unit. Model 86-848 features the gold-plated, Evenray radiant wall. It is designed for drying of enamels, lacquers, and undercoats on either passenger cars or commercial vehicles. Despite the large areas, up to 40 square feet, handled by this unit, it is easily moved and can be readily adjusted by one man for all types of jobs.

Fostoria Pressed Steel Corp., Fostoria, Ohio

This is the Tape that Electrical Men Made Famous

No other application demands so much in the way of high performance — dependability — in friction tape as does electrical work.

And that's why electrical men of long experience insist on Bull Dog, the tape that never lets them down.

It grabs tight, holds tight . . . never ravels or frays . . . leaves no unsightly, messy edges . . . stays fresh on the roll . . . resists drying out *on the job.*

Yes, electrical men who know use Bull Dog — and recommend it to young men on the way up.

Next time you buy friction tape, make it a point to try Bull Dog. You'll like it!

Use Bull Dog Splicing Compound for Top Notch Insulation

Bull Dog Splicing Compound is unsurpassed for high resistance to electricity and water. Self-vulcanizing into a solid, watertight joint. Buy it from your Bull Dog Friction Tape supplier.

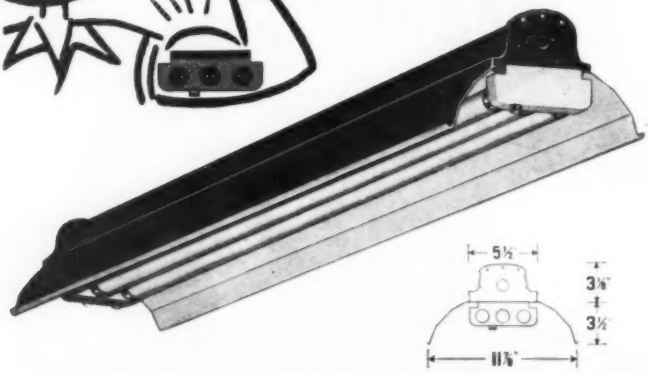
BWH
DEPENDABLE RUGGEDNESS

BOSTON WOVEN HOSE & RUBBER COMPANY

Distributors in all Principal Cities

PLANT: Cambridge, Mass. • P. O. Box 1071, Boston 3, Mass., U.S.A.

New Muscles for SAMSON!



METALCRAFT'S 40-WATT FLUORESCENT INDUSTRIAL UNIT NOW AVAILABLE WITH

Turret Sockets

IN TWO- AND THREE-LAMP SIZES

Now SAMSON's tougher than ever, with turret sockets that add extra ruggedness and provide more positive electrical contact. Built of heavy gauge steel die-formed to insure uniform construction, the SAMSON provides maximum light, is quickly installed, easily maintained . . . a real heavyweight champion in its class.

Also available with conventional sockets in 2-lamp size. Porcelain enamel or baked enamel finish, white inside, gray outside. Instant start type also available. Quarter-turn "Shakeproof" wing nuts. Specially inserted die-formed socket plates. Cross members for extra rigidity.

Also Available with Hinged, Fully Removable, Egg Crate Louver Assembly

the Metal-craft line

METALCRAFT PRODUCTS CO., INC. • Manufacturers of Fluorescent and Slimline Luminaires • **Mascher & Lippincott Sts., Phila. 33, Pa.**

Selector Switch **(32)**

Class 9001 Type TSK key operated selector switch has been added to this line. Unit is available as a two or three position switch with a variety of cams and contact blocks. Suitable for applications where operation in all or certain positions of the unit must be denied to unauthorized personnel for safety or other reasons. Every possible combination of key withdrawal (locking) positions for two and three position selector switch is available.

Square D Company, 4041 North Richards Street, Milwaukee 12, Wis.

Product Briefs

(33) Auth Electric Company, Inc., Long Island City, N. Y., has developed a **nurses' call locking button** available as replacement. . . . (34) Air Reduction Sales Company, New York, N. Y. has announced a new 200 ampere **transformer welder.** . . . (35) A lead-free **aluminum solder rod,** melting at 400°F and flowing at 450°F, has been developed by All-State Welding Alloys Company, Inc., White Plains, N. Y.

(36) Wodack Electric Tool Corp., Chicago, Ill. has introduced a new "Do-All" electric **hammer and drill.** . . . (37) W. H. Brady Company, Chippewa Falls, Wis. has developed **Quik-Masks,** self-adhesive, pre-cut masks and gaskets to be applied without moistening to areas requiring protection. . . . (38) For checking temperature of molten babbit metal, solder, lead, etc., an improved **Temperometer** has been announced by W. C. Dillon & Company, Inc., Forest Park, Ill.

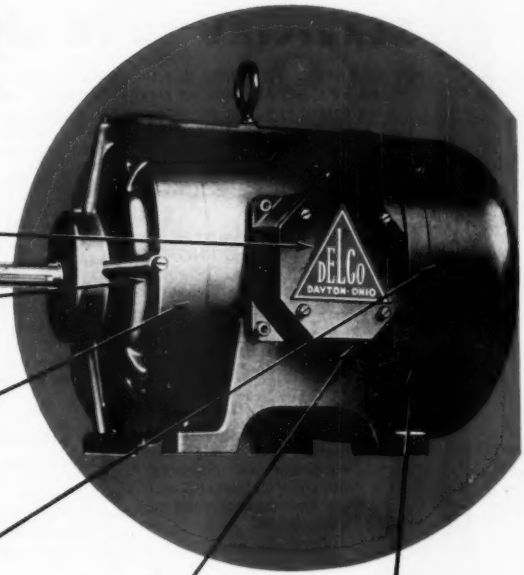
(39) A portable **electronic signal flasher,** without moving parts or filaments to burn out, has been announced by the Haledy Electronics Company, New York, N. Y. . . . (40) The Dumore Company, Racine, Wis., has developed a new **drill** for 2-lip twist drills, from No. 70 to ¼ inch, either straight or tapered shank. . . . (41) Topflight Tape Co., York, Pa. has announced pressure-sensitive waterproof cloth **labels** for identification of parts.

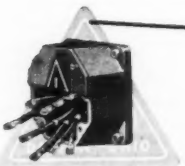
(42) H. I. Thompson Company, Los Angeles, Calif., has developed a new high temperature **sleeving and insulation** that is finding wide industrial use. . . . (43) A revised line of Type JA rotary **selector switches** has been announced by the United States Instrument Corporation, Summit, N. J. . . . (44) A high fidelity, two speaker portable **public address system** has been introduced by Newcomb Audio Products Co., Hollywood, Calif.

GO DELCO...

give motor trouble the BRUSH OFF

Delco engineering has put a lot of extras into Delco Motors . . . and all for one reason: To give you a motor that will drive production machinery longer hours, with less chance of motor breakdown. Look over the rugged motor features below . . . and "go Delco."





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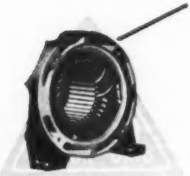

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Permanently flexible, moisture-proof and wear resistant

POSITIONED BEARINGS
Maintain shaft alignment

DYNAMICALLY-BALANCED ROTOR AND SHAFT ASSEMBLY
Reduces vibration, wear

CORROSIVE-RESISTANT CAST IRON FRAME
More solid, more rugged

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SERVICING YOUR LIGHTS!
GIRAFFE: I'll report this to the S.P.C.A.! My contract says I'm an entertainer, not an extension ladder!
MAINTENANCE MAN: Now don't get excited! You can go back to the circus after I clean these lights.
Well why the S#©%*¢ don't you install THOMPSON HANGERS? Then you could clean these lights at floor level whenever necessary.
Thompson Hangers? Whadda they do?
They lower overhead lights to floor level for servicing. What's more, they completely eliminate all climbing and electrical hazards and cut maintenance costs to a minimum!
S-a-a-a-a-y, that sounds terrific! Are they complicated . . . hard to operate?
The THOMPSON HANGER is simplicity itself! All up-and-down movement is controlled by a chain or cable that's part of the installation, and the hanger automatically repositions itself when raised. The live electrical contacts stay at the top. It's safe and foolproof!
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Write to The Thompson Electric Co. and ask for CATALOG No. 50. It will give you the complete story. Now slide down, chum, and turn me loose!
In traveling with The Big Top, the giraffe has seen many THOMPSON HANGER installations, and he has learned that in each (1) maintenance costs are down to absolute minimum, (2) lighting service men have top safety records and (3) all lights are operating at peak efficiency to facilitate round-the-clock production operations.
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CATALOG No. 50 describes THOMPSON HANGERS and accessory items in detail
1. DISCONNECT
2. LOWER
3. SERVICE
4. REPOSITION
5. REPEAT
THE THOMPSON ELECTRIC CO.

CATALOGS and BULLETINS

(45) TUBINGS AND SLEEVINGS for electrical insulation are subject of bulletin No. 250A including technical data on classes, sizes and performance specifications. Insulation Manufacturers Corp., 565 West Washington Blvd., Chicago 6, Ill.

(46) GEARMOTORS and speed reducers are described in 96-page catalog with technical data on hp ratings, ratios, selection and installation. Abart Gear & Machine Co., 4834 West 16th St., Chicago 50, Ill.

(47) VERTICAL INDUCTION MOTORS, their ratings, construction and type, are discussed in bulletin 05B7629. Allis-Chalmers Co., Milwaukee 1, Wis.

(48) TRANSFORMER OIL purification unit is the subject of bulletin covering description, operation and application of mobile unit for the reconditioning of deteriorated insulating oils. Honan-Crane Corp., Lebanon, Ind.

(49) HYDRAULIC EQUIPMENT for lifting, pulling, pressing, pushing and bending are illustrated and discussed in bulletin including pipe benders, jacks and wrenches. Blackhawk Mfg. Co., Milwaukee 1, Wis.

(50) INDUCTION MOTORS, large squirrel-cage, are described in bulletin 05B7542A showing construction details and application data. Allis-Chalmers Co., Milwaukee 1, Wis.

(51) BOLT AND PIPE THREADING machines, metal and wood cutting band saws, and other industrial supplies are described and priced in loose leaf catalog. Capewell Manufacturing Co., 60 Governor St., Hartford, Conn.

(52) BATTERY servicing and re-processing, including case histories, are discussed in two-color, illustrated booklet on battery AD-X2 compound. Pioneers, Inc., 2411 Grove St., Oakland 12, Calif.

(53) ELECTRIC POWER for quick expansion is the subject of 24-page bulletin GEA-5600 describing the use of "packaged" electrical systems in industrial expansion. General Electric Co., Schenectady 5, N. Y.

(54) SCHOOL LIGHTING design information and technical data are offered in two illustrated booklets. Day-Brite Lighting, Inc., 5411 Bulwer Ave., St. Louis 7, Mo.

(55) POWER EQUIPMENT designed to meet the needs of pulp and paper mills is discussed in 16-page bulletin GEA-5521 including photographs and diagrams on the application of power generation and distribution equipment. General Electric Co., Schenectady 5, N. Y.

(56) COPPER WEIGHTS per 1000 feet of the most common sizes and types of electrical wire and cable are listed in bulletin which determines usage of wire and cable in terms of copper poundage. Rome Cable Corp., Rome, N. Y.

(57) CAPACITOR catalog 420-421, 60 pages, describes and illustrates the widest range of mica and Faradon capacitors for commercial, industrial and military application, including JAN unit designations, characteristics, derating, dimensions and selection data. Cornell-Dubilier Electric Corp., South Plainfield, N. J.

(58) DISTRIBUTION TRANSFORMER, Curvacore Design, is the subject of bulletin 61B7641 describing construction features, dimensions, types, regulation and ratings. Allis-Chalmers Co., Milwaukee 1, Wis.

(59) SELENIUM RECTIFIERS are discussed in 4-page bulletin including applications, design, construction, sizes and ratings. Syntron Co., Box 220, Homer City, Pa.

(60) ELECTRICAL FITTINGS, brass and steel screw machine parts, and assorted hardware specialties are listed in catalog 49. Monticello Specialties Co., 9 Great Jones St., New York 12, N. Y.

(61) HOSPITAL ELECTRICAL PLANNING is the subject of a 240-page book presenting planning data, recommended electrical equipment in a room-by-room analysis, load calculations, equipment layout and detailed description of lighting, signalling and x-ray. Westinghouse Electric Corp., Agency and Construction Dept., 12-L, East Pittsburgh, Pa.

(62) ELECTRIC HEATING ELEMENTS are described and illustrated in bulletin covering design and application data for industrial heating problems. Syntron Co., Box 220, Homer City, Pa.

(63) INDUSTRIAL SUPPLIES, cutting tools, gages, and machine tools are listed with specifications and prices in 178-page catalog. DoAll Co., Des Plaines, Ill.

(64) BATTERY CHARGER bulletin 11-220 describes and illustrates four-circuit motor-generator charger. The Electric Products Co., Clarkstone Rd., Cleveland 12, Ohio.

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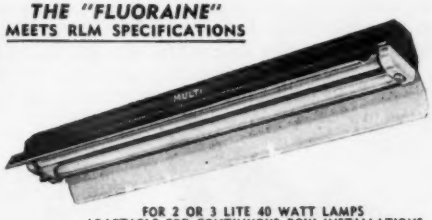

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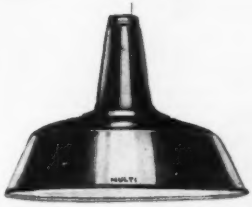

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Powerful Milwaukee HOLE-SHOOTER combines straight and right-angle drilling . . . wonder-tool for close quarters

Built for use by electrical contractors and plant maintenance electricians, this Milwaukee ½" HOLE-SHOOTER — *America's only 3-speed Right-Angle Drill* — has demonstrated its unmatched time-saving performance on thousands of jobs. Most powerful drill built for its size and 9-lb. weight. Ball and roller-bearing equipped for extra-long service life.

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For straight drilling, S-412 ½" HOLE-SHOOTER (above) has a chuck speed of 450 R.P.M. With the 2-speed "Right-Angle Drive" attachment, speeds are 300 R.P.M. or 675 R.P.M.

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3 flats specially machined on shanks of these bits to fit Jacobs 3-jaw chuck.

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(65) ELECTRONIC CONTROL system for process and power instrumentation is the subject of 4-page bulletin A-701 describing with photographs and schematic diagrams the applications of this all-electronic system in controlling pressure, temperature, flow and level. The Swartwout Co., 18511 Euclid Ave., Cleveland 12, Ohio.

(66) RESEARCH REPORT on the nature of copper corrosion is a 24-page booklet discussing the corrosion resistance of copper and copper alloys, including tabulated technical data on the principal types of copper and copper base alloys. The American Brass Co., Waterbury 20, Conn.

(67) RESISTANCE WELDING of nickel and high nickel alloys is the subject of 32-page bulletin T-33 presenting tables on mechanical properties, chemical compositions, recommended conditions for welding and other information. The International Nickel Co., Inc., 67 Wall St., New York 5, N. Y.

(68) MERCURY SWITCHES are described in condensed catalog Hg-1, covering the five most popular designs, with selection and application aids, and electrical ratings and data for ac and dc use. Micro-Switch, Freeport, Ill.

(69) TEMPERATURE-indicating crayons, pellets and lacquers that melt at predetermined temperatures are subject of pocket-sized folder. Tempil Corp., 132 W. 22nd St., New York, N. Y.

(70) IGNITION TRANSFORMERS for automatic heating equipment such as domestic oil- and gas-fired heating equipment, equipped with 2-way self-shielding to suppress radio and television interference, are illustrated and discussed in GEA 5599. General Electric Co., Schenectady, N. Y.

(71) PORTABLE ELEVATORS and material hoisting towers are specified in 2-color catalog insert sheets PS 28P-7-51. Wilson-Albrecht Co., Inc., Minneapolis 16, Minn.

(72) LINE SUPPORT clamps and blocks for industrial use, with detailed sketches covering materials, finishes and sizes, are subject of 1951-52 engineering manual. Thomas Associates, Los Angeles 39, Calif.

(73) TOOLS such as wrenches, punches, chisels, screwdrivers, pliers, tool boxes and related equipment necessary for servicing operations and maintenance work are presented in catalog TR. Snap-on Tools Corp., Kenosha, Wis.

(74) BATTERY pocket-sized 56-page handbook discusses charging, control

of discharge, automatic control of charging and equipment maintenance. Gould-National Batteries Inc., Trenton, 7, N. J.

(75) ELECTRICAL CONNECTORS that can be mated without matching prong and sockets, with interchangeable halves, are presented in catalog 49B. Albert & J. M. Anderson Mfg. Co., Boston 10, Mass.

(76) METAL FRAMING is discussed as to available sections, connecting accessories, load data and installation pictures in AIA file 14G published by Unistrut Products Co., Chicago 7, Ill.

(77) GRINDER with new arbor construction, extra exhaust positions, auxiliary handle, rubber faced valves and more power is discussed in form 5096-4E1 by Ingersoll-Rand, 11 Broadway, New York 4, N. Y.

(78) SINGLE PHASE repulsion start induction brush lifting motors with ratings from ½- to 20-hp are subject of form 942. Century Electric Co., St. Louis 3, Mo.

(79) INSTRUMENT SELECTION information is provided in 30-page booklet describing types and functions of instruments. Westinghouse Electric Corp., Pittsburgh 30, Pa.

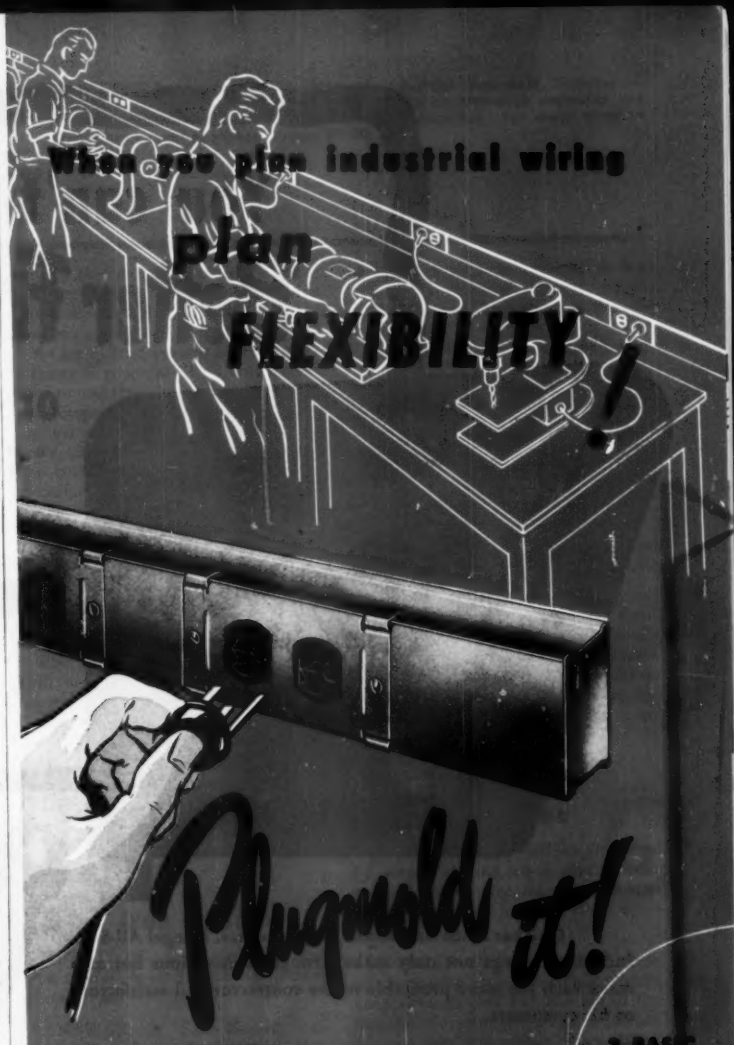
(80) ELECTRONIC RECORDER for measuring and recording the frequency of electrical power production is discussed with specifications and circuit diagrams in 2-page Instrumentation Data Sheet No. 9.1-8. Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa.

(81) BATTERY SERVICING is the subject of data sheets describing restoration to full service of motive power storage batteries which have lost capacity due to sulphation of the plates. Gould-National Batteries, Inc., Trenton 7, N. J.

(82) FREQUENCY CONVERTERS are described and illustrated in bulletin GEA-5637, covering three-phase induction equipment from ½ to 100 kw. General Electric Co., Schenectady 5, N. Y.

(83) CONNECTORS for portable electrical equipment, 20 to 200 ampere ratings, are discussed in new bulletin on circuit breaking series of plugs and receptacles. The Pyle-National Co., 1334 N. Kostner Ave., Chicago 51, Ill.

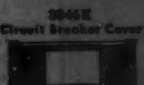
(84) PROTECTIVE LIGHTING is the subject of 24-page booklet providing complete plans for outdoor industrial lighting, application suggestions and techniques, and mounting methods. Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.



A heavy duty multi-outlet system, 3000 PLUGMOLD is widely used for industrial applications requiring closely-spaced, correctly located receptacles for the handy plug-in of small motors and electric tools.

An important feature of the 3000 system, the 3046 series cover fittings provide a wide range of flexibility. New Additions to this line include the 3046K cover that accommodates Quick-Lag type circuit breakers to control individual circuits or devices . . . and the 3046L for Fustat units. Other covers permit use of single receptacles, duplex receptacles, tumbler switches, surface devices, sign receptacles, conduiet devices, and fixture and drop cord. Easily installed, covers are furnished with clips that: (a) serve as wire clips, (b) support device in the raceway and hold it securely in place. Clips line up device with cover, save wiring time!

3046K
Circuit Breaker Cover



3046L
Fustat Device Cover

The 3000 System can also be installed as risers and as a branch circuit system . . . to feed and suspend lighting fixtures.

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You can't buy Better Fittings or ones that cost less to use

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Quicker to use and neater in appearance, Briegel All-Steel Indenter Fittings not only make stronger connections but also make each job more profitable to the contractor and satisfactory to his customers.

Two Easy Squeezes and they're set to stay. It is only natural that the Briegel All-Steel Indenter Fittings are the most widely used E.M.T. connectors and couplings. Contractors the world over recognize their cost cutting qualities and the fact that they make each wiring job neater, stronger and better.

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QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

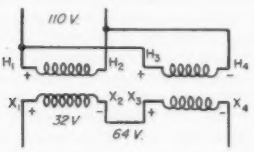
Reader's Quiz

Connecting Transformers

QUESTION R18—I want to obtain about 64 volts and I have available a 110 volt supply and transformers rated 110 to 32 volt.

Would it be satisfactory to connect two of these together: the primaries in parallel on 110 volt and the secondaries in series? As I see it, the only precaution I would need to take is to see that the load current does not exceed the rating of the smallest transformer.—R.J.S.

ANSWER to R18—If a transformer or transformers are used which have four coils it will be satisfactory to connect the primary coils in parallel for 110 volt and the two secondary coils in series for 64 volt. This is shown in the following sketch.



If H_4 is connected to H_1 and H_3 to H_2 then polarity is incorrect and high current will result.

If X_4 is connected to X_2 and X_3 to line then polarity is incorrect and zero voltage will be read between X_1 - X_2

The coils in the primary circuit must be so connected that the flux set up by each coil will be in the same direction; otherwise the combined effect will be to demagnetize the core and thereby cause a heavy rush of current in the circuit. The coils in the secondary circuit must also be so connected that the induced e.m.f.'s are in the same direction in each coil or the resulting voltage will be zero.

The primary connections can be checked with the aid of a circuit breaker between the transformer and the line. If the circuit breaker blows then the polarity is reversed and the connections must be changed. The secondary connections can be checked with a voltmeter by measuring the voltage across each coil and across the two in series. If the voltage across the two in series is the difference of the voltages across each, terminals of like polarity have been connected together. If, however, the voltage across the two coils in series is the sum of the voltages across the coils, then, terminals of unlike polarity have been connected together and the connections are correct.

As far as load current on the transformers is concerned it is only necessary to see that the current rating of any single coil is not exceeded. In the primary side current splits and flows through both coils so that the line current will be the sum. In the secondary side the same load current will flow through each coil.—R.W.M.

ANSWER to R18—It will be perfectly satisfactory for R.J.S. to connect the transformers as suggested by him to increase the voltage to 64 volts.

One transformer is being used as a booster which is common practice.

The load, as suggested should be held to the capacity of the smallest transformer.

The precaution to take when using an ordinary control transformer to buck or boost is to be sure that the secondary winding of the transformer has the proper insulation to withstand the voltage to which it will be subjected.—B.A.S.

Buried Iron Conduit

QUESTION S18—How long will iron conduit in its passive state last in a cinder fill?—H.S.

ANSWER to S18—Buried iron conduit has a few natural enemies, aiming at its destruction. They are: Mechanical shock and vibration, strong chemicals, water, electrolytic corrosion and effects of old age.

Mechanical vibration and friction tends to remove protective coating from the surface of a conduit and thus allows moisture to attack the iron. Sharp tools can bend and penetrate through walls of conduit causing, in addition to mechanical damage, electrical troubles.

Moisture is present both on outside and inside of a conduit and contributes to deterioration of a conduit.

Electrolysis—complicated phenomena caused by galvanic action between dissimilar metals buried in a suitable ground may destroy conduit in a very short time.

Effect of old age can be given as an application of the above mentioned elements not in a continuous manner but occasionally in small dosages, which in the course of years shortens the life of a conduit.

Due to all these facts the use of bare metallic conduits in underground installation is generally avoided. Transite fibre, soapstone and other types of non-metallic ducts are used for such purposes.

The maximum length of life of buried metal conduit will depend on exposure to above mentioned conditions.

It would be very optimistic to expect more than 20 to 25 years of service out of any buried iron conduit.—W.J.P.

ANSWER to S18—I have dug up conduit from under concrete floor which was imbedded in cinders for 25 to 30 years. In some places this conduit looked very good, and in other places it was completely eaten away by chemical action, so no set time can be given for conduit to last imbedded in cinders.—E.S.H.

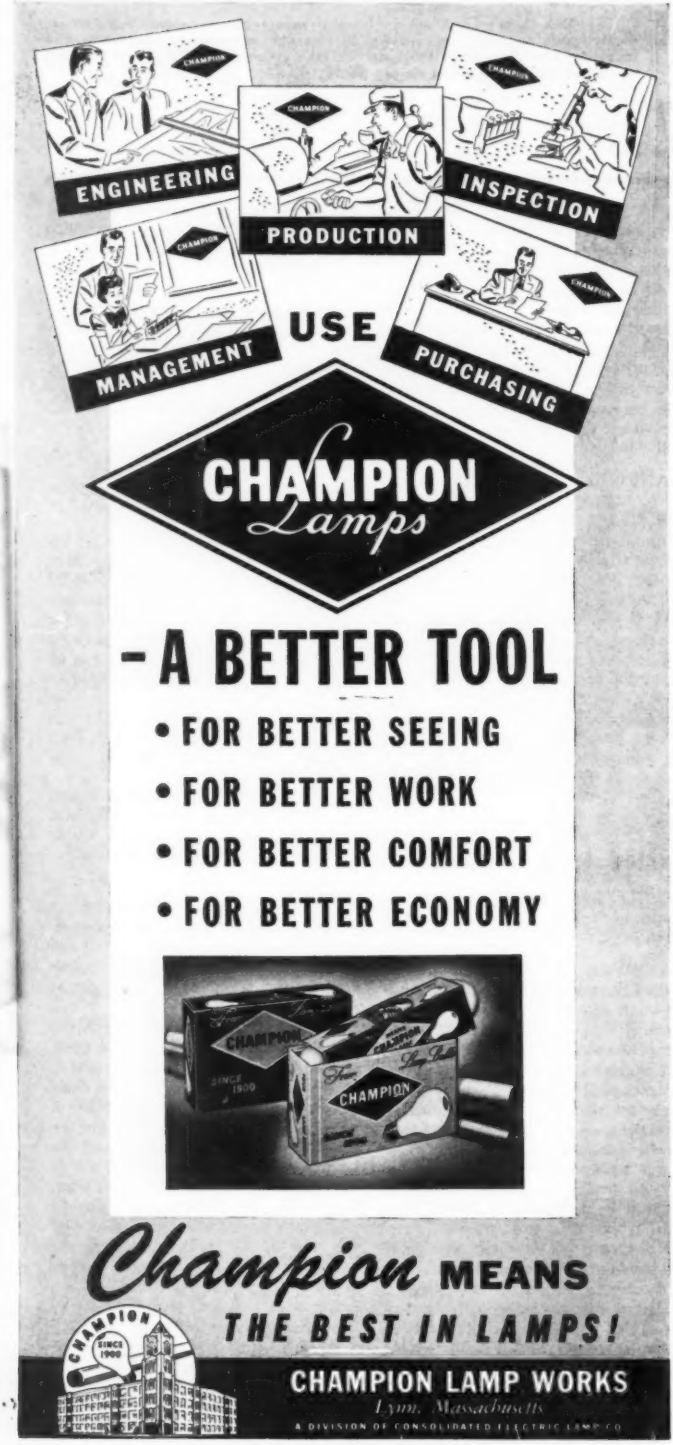
Motor Protection

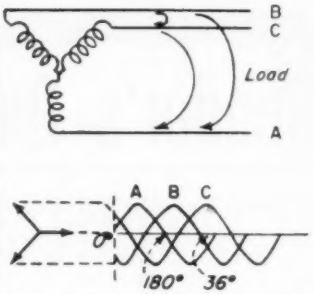
QUESTION T18—What is meant by single phasing on a three phase system? How does this cause motor burnouts and how can it be avoided?—R.W.D.

ANSWER TO T18—The term single phasing on a three phase system simply means that any one leg of the three wire system opens up. To further explain this examine a three phase system.

A three wire system of lines A, B, and C represent three phase or three single phases interconnected together so that lines A-B are one phase, lines B-C are a phase and lines A-C are a phase. The currents in each line or phase are indicated by arrows and can be represented by three sine waves 120 electrical degrees apart. Therefore if any one line opens up due to electrical or mechanical reasons one of the coils of the energy source is removed and the other two coils are in series and single phase condition exists with only one current flowing from the source to the load.

When motors are connected to a three phase system and single phasing occurs the line current will increase by the ratio 1.73 times the normal current, while a single phased two





phase motor draws twice the current it would draw from a symmetrical system. As most motors have service factor of 1.15 times the normal full load current it can be seen that the motor will be overloaded and will overheat. This overheating can be prevented by using a motor controller with overload relays. The relays are connected in two of the motor lines and operate by temperature rise caused by the line current flowing in a heater element. These relays are generally selected to have a rating of 1.15 to 1.30 times the normal full load current of the motor and are designed to follow the motor heating curve. Thus if the line current rises due to single phasing, the heaters of the relays will operate and release a trip mechanism which in turn will disconnect the motor controller contacts and the motor from the power line. If R.W.D. will check he will find that this protection is required by the National Electrical Code for practically all motor installations. —R.W.M.

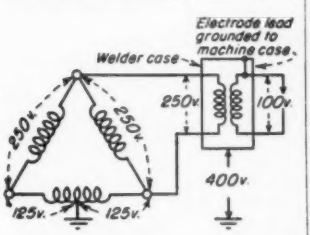
ANSWER to T 18—Occasionally one of the three line wires feeding a three phase motor will become open circuited, leaving only two energized lines. This results in the motor attempting to carry the load on one phase. If the motor is already running, it will continue to run provided the load is not too heavy. However, since the horsepower of the load does not change, one phase winding must now produce the power developed in three, and may be seriously overloaded. If the motor is standing it will be unable to start (single phase motors having no natural starting torque), and locked rotor conditions with the resulting high current will prevail. In either event the excessive current threatens insulation life and, if sufficiently high, can burn out the motor windings.

The major causes are loose terminal connections, broken wires, magnetic contactors or starting switches which fail to make contact on all three phases, and blown fuse in one of the phases. Best insurance against single phasing is the use of circuit breakers which open all three phases in place of indi-

vidual fuses, frequent cleaning and adjusting of starting contacts and periodic inspection of all motor connections and wiring.—D.H.N.

Welding Machine

QUESTION U 18—I have a 500 amp single phase transformer type arc welder which is rated at 220 volts input and 75 volts open circuit output. This welder is connected to a 250 volt circuit and produces approximately 100 volts on the secondary or welding side. The electrode terminal or "hot side" is connected to the case of the machine. The case is not grounded.



It was discovered that approximately 400 volts existed between the case of the machine and the electrical ground of the distribution system thus creating quite a hazard.

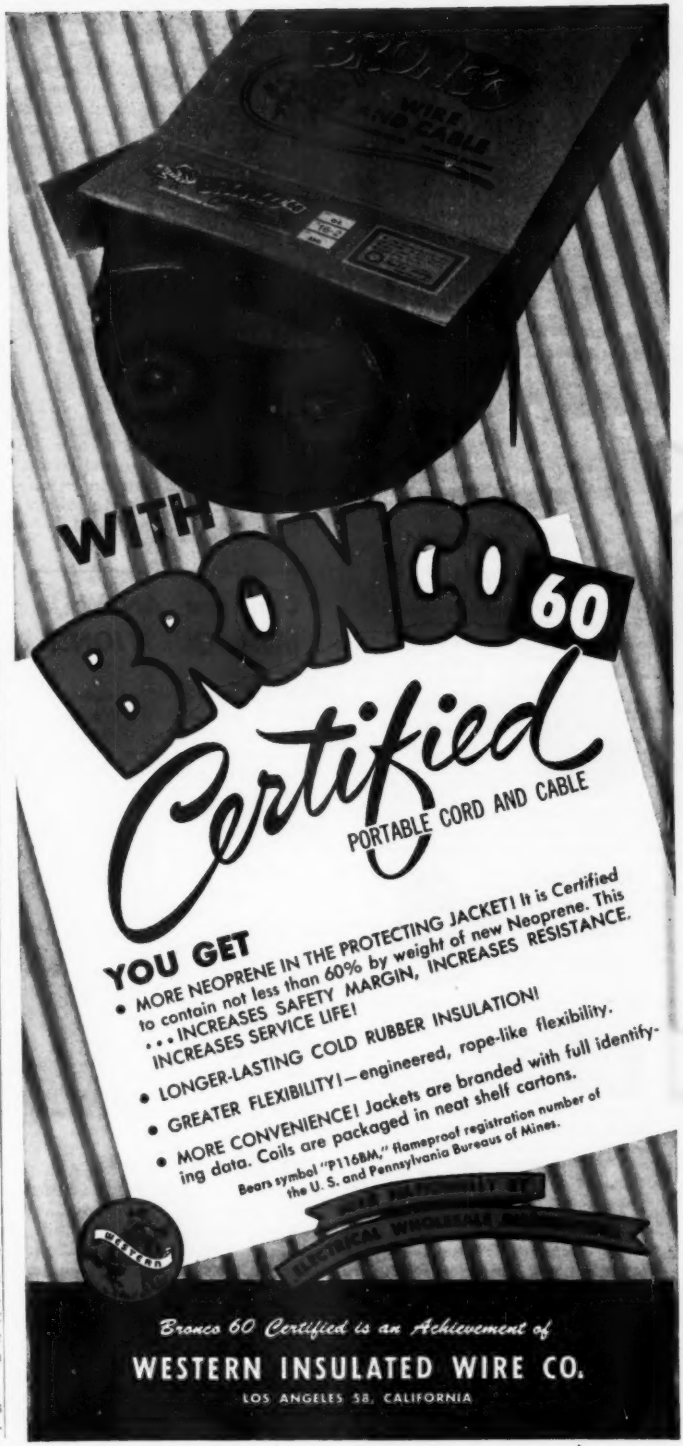
A continuity check showed no connection between either primary lead and the case of either secondary lead. The power supply to the welder is three phase, three wire delta with a grounded midtap on one phase. Voltage from input leads to ground measure 216 volts and 125 volts respectively.

The welder works ok. What and where is the cause for the 400 volts to ground?—E.A.E.

ANSWER to U 18—From the diagram presented it is clear that the electrode has been placed on the wrong secondary terminal of the welder. The electrode and ground leads should be interchanged and then the case should be securely grounded to earth or other suitable ground. This will stabilize the case of the machine and the welding work material at zero potential with respect to earth, and the welding electrode at 100 volts potential above ground. When these changes have been made more consistent welding performance should result.

At the present time the secondary of the welder is "floating" and may have any potential with respect to ground. There is also the present danger that the welding work may have a voltage difference with respect to ground from 300 to 500 volts.—M.C.R.

ANSWER to U 18—From E.A.F.'s description of his welding machine sit-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uation, it would seem that there can be only two possible answers. One, even though he says a continuity test showed "no connection between the primary 220 volt leads and the case or between the primary and secondary leads," he does not say how this test was made. It is quite possible that there is a high resistance connection between the primary leads, or winding, and the transformer case. A controlled current test of his "400 volts" would quickly show whether or not this was so. Probably he couldn't get enough current between case and ground to light a 10 watt lamp. A Megger resistance test would also be effective in determining whether there is a high resistance leak. The other is that the condenser effect is building up a charge between case and ground. I suggest that he make a controlled current test between case and ground. In any event, his transformer case should be securely grounded to prevent accidental shock.—W.B.M.

Can you ANSWER these QUESTIONS?

QUESTION G19—What causes a dc motor to reverse itself? We had one on a grinding machine, that after running constantly for a few days, would reverse itself. Could it be due to eddy currents?—L. C. T.

QUESTION H19—I would like to know how to figure the (ohms) resistance needed for a discharge resistor for a synchronous motor. We have a 150 hp., 440 volt, 3 phase, 60 cycle, 400 rpm. motor, secondary voltage, 125, amps 45. We do not have the right discharge resistors and would like to know how to figure out what is required.—A.T.

QUESTION J19—If one fuse is blown on a three phase, delta-wound motor, will this motor start and run without outside assistance, no-load?—H. V. S.

QUESTION K19—Some power companies are objecting to the installation of local "standby" plants on farms and residences unless a three pole double throw switch is installed and arranged to open the line neutral when the plant is in operation. They maintain that opening the "hot" legs only is not safe as any current flowing in the neutral could energize their primaries.

Most of the standby plants are 115 volt, 2 wire. The outside or hot wires are tied together by throwing a switch after the main switch is pulled and all 230 volt appliances are left off during the outage period. The neutral, of course, carries full amperage.

Other plants are 115/230 volts, 3 wire and operate all appliances up to the capacity of the plant. The neutral carrying any unbalance current.

Will some one please show, by diagram, how this current in the neutral only can energize the primary to a dangerous voltage on single phase high line with one primary line grounded and common to the secondary neutral, such as an R.E.A. system?—E. R.

QUESTION L19—I would like to know a simple way to check fluorescent ballasts in the field as well as in the shop. I am interested more in the 40 watt single and two lamp ballasts. It is rather expensive to put in a new lamp and have it go out at once. I find no data on what the resistance should be in the circuits.—C. S. S.

QUESTION M19—On a three phase system with unbalanced load will the line currents change if the phase rotation is changed?—R. J. S.

QUESTION N19—We have a G.E. Type S.A. ¼ hp, 1725 rpm motor on a residential furnace circulating fan on which the brush springs heat badly. The springs will not last over three or four weeks. The collector rings are in good shape and contacts bright. Can you give me a possible cause and remedy?—I. E. S.

QUESTION P19—When connecting 3 phase motors to the line, we usually connect the three line wires to the motor without regard to phase and apply current momentarily to check direction of rotation. If rotation is wrong we reverse two of the leads either at the motor or contactor.

On machines where the motor is direct connected and operation of the motor in the wrong direction even for a few revolutions may damage the driven machine, this method of testing cannot be used.

Would like to know if there is a standard method of marking the motor leads so that when the phase sequence is known, the connections can be made for proper rotation without an actual running test.

For instance, should T1 connect to phase A, T2 to phase B and T3 to phase C? What is the standard marking of motor leads in this respect for 2 and 3 phase motors?—E. E. M.

PLEASE SEND IN YOUR ANSWER BY NOVEMBER 15

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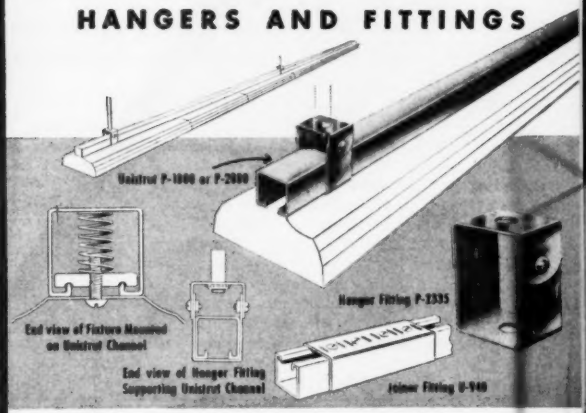
BEFORE VIEW of study hall of Jackson High School, Jackson, Michigan. Approximately 49 ft. by 83 ft. with 20 ft. ceiling. Twenty-one 16 in. opal glassware chain suspension fixtures with 200 watt lamps. Fixtures suspended 10 ft. above floor. Average illumination was 5 to 8 foot-candles.

AFTER VIEW of same study hall showing 4-lamp 40-watt fluorescent fixtures in continuous rows completely supported with Unistrut P-2000 channel and suspended 13 ft. above floor with ½ in. conduit stems, canopies and Unistrut Hanger Fitting P-2335. Average maintained foot-candles is 35-40.

Lighting recommendations by and photographs courtesy of Consumers Power Company, Jackson, Michigan.


Unistrut P-1000 or P-2000
Hanger Fitting P-2335
End view of Fixture Mounted on Unistrut Channel
End view of Hanger Fitting Supporting Unistrut Channel
Joiner Fitting U-949

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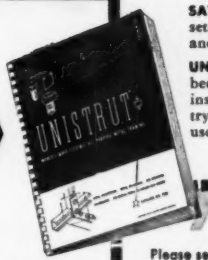

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Bi-pin type "Springlox" for 2 or 3 lamps

transparent view of "push end" shows how flexible spring base simplifies lamp insertion

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B5490B

Industrial Electrification

Distribution Trends

The growing utilization of load center distribution systems, plug-in bus ways, greater short-circuit protection, higher secondary voltages and power systems with grounded neutrals are trends in both modernization and new-construction.

By D. L. Beeman
Manager, Industrial Power Division
General Electric Co.
Schenectady, N. Y.

ALL parts of a modern industrial plant are important: structures, heating, ventilating, lighting, plumbing and foundations. To say that electric power is more important than water, gas or building steel would be pointless. Yet it is a fact that power is a component of the product produced to a greater extent than machine tools shaping raw materials into useful forms.

It is essential to realize that the distribution system is the vital link connecting power source with production equipment. Take away power for a few moments because of a fault in the system and production stops. And, since profits are proportional to production, profits depend upon power being available when and where wanted. Insuring this continuity of power is the function of the distribution system.

Distribution systems generally cost from 2% to 10% of the building investment; generally from 1% to 5% of the total plant cost including machinery. This is a small investment for the amount of service involved, emphasizing the wisdom of installing the best available electrical equipment to assure maximum profits from overall plant investments.

Power systems should be considered as entities, for although they are installed in parts, they nevertheless function as complete integrated units and should be so planned. For example; transformers cannot be considered without necessary switchgear. For transformer size determines the amount of short-circuit current, dictating the switch-gear interrupting requirements.

Before selecting equipment, the system should be analyzed from source to load. The best way to secure this overall picture is with a one-line diagram; showing the system in its entirety, giving a reasonable idea of sevice reliability, and indicating how components will fit together.

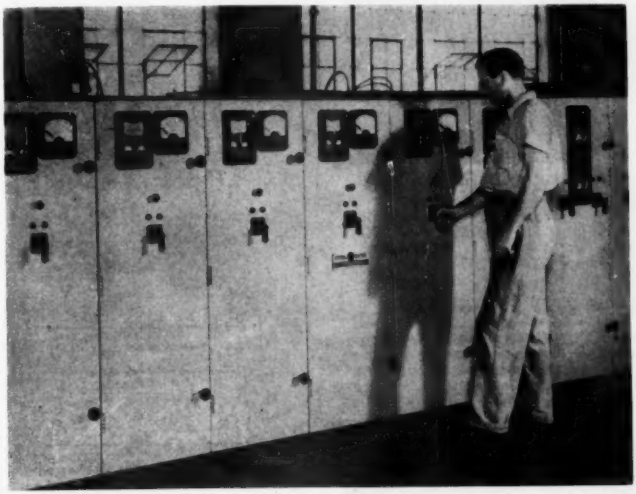
There has been a marked, accelerating trend towards *load center distribution systems*, consisting basically of high-voltage distribution to load centers where power is stepped down to utilization voltages through small load center unit substations. Compared with old-style live bus-fuse-and-switchboards, these modern load centers are:

1) *Less expensive*, with first costs running from a few percentage points to well over 50%. A study of several hundred installations covering a wide range of kva capacities indicated an average saving of 20%.

2) *Safer*, with all live parts encased in grounded metal, and non-inflammable transformers replacing oil-filled units.

3) *More flexible*, because there are many circuit arrangements available with varying degrees of service continuity. These include the lowest-cost radial systems, the popular secondary-selective systems with dual supply channels for greater service reliability and maintenance flexibility, and the more complicated and costly secondary networks.

4) *Easily expanded*, to care for future load growth. Since new capacity can be added in small blocks to match gradual plant growth, system investments can be kept to a minimum. Also, new substations can be added and connected to existing or new high-voltage feeders without increasing the short-circuit duty on any other substation. And new substations can be added at the spot where the load grows, thus



LOAD CENTER distribution systems are finding wide acceptance due to their economy, safety, flexibility and performance.

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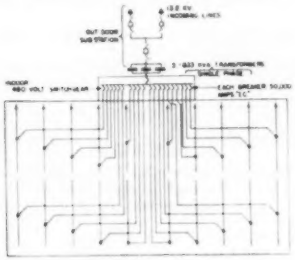
bringing the power at high voltage right to where it is to be used. If the proper selection of primary voltage has been made and primary switchgear has been selected with a margin for growth, the load center system can be expanded almost indefinitely at low cost to meet the requirements of any manufacturing process.

5) *Less affected by voltage drop*, because in the load center system secondary feeders are short. Load center voltage drop is rarely over 2% or 3%, whereas in large central substation systems with long low-voltage feeders the voltage drops frequently ran from 12% to 20%. Lower voltage drop in the load center system results in better performance of lights, motors, heating devices and all other utilization equipment plus the fact that, with better voltage, they will produce more and thus return a higher investment value. The necessity of good voltage cannot be overstressed for modern manufacturing processes include many uses of



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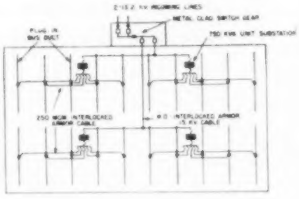
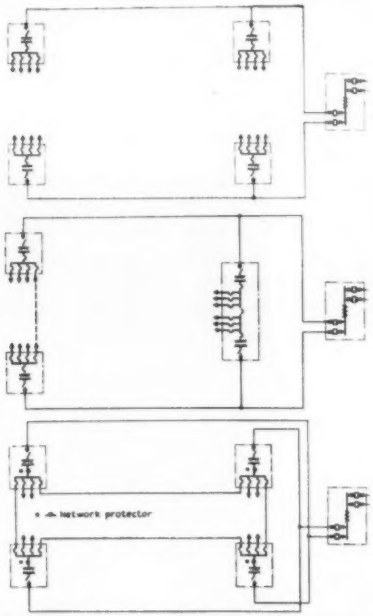


LOAD CENTER
$ 50,000

SAVINGS 17%

ECONOMY of load center distribution systems, compared with old-style live bus-fuse-switch boards, frequently exceeds 50 percent, with average savings close to 20 percent. The actual installation here diagrammed saved 17 percent: $50,000 (load center) compared to $61,000 (old style).



FLEXIBILITY is another reason why load centers are popular, for many circuit arrangements are available for varying degrees of service continuity. Radial, secondary selective and network systems, with several variations, can be installed. Each system has its advantages.

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Bellwood, Illinois

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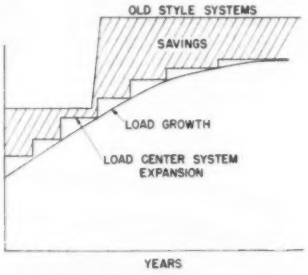
electricity in addition to motors. Intricate controls and some types of radiant heating, for example, require extremely close regulation to insure maximum effectiveness of operation.

Plug-in Bus Ways

The future will see more flexibility built into secondary distribution systems through the use of plug-in bus ways, permitting the plugging in of tools and machines much after the fashion of plugging in home appliances and lamps in residential baseboard outlets. This saves a staggering amount of money in modern industrial production lines where machines are moved frequently to obtain the most productive factory arrangement. Many instances have already demonstrated the practicality of moving complete manufacturing departments from one building to another over a single week end without interfering with normal production, thanks to the advantages of these plug-in systems.

Increasing attention is being directed towards short-circuit protection,



LOW COST EXPANSION with load centers makes it possible to add capacity in small blocks to match gradual plant growth. New substations can be added close to the center of new loads and, where primary voltage and switchgear permit, expansion can be carried on indefinitely.

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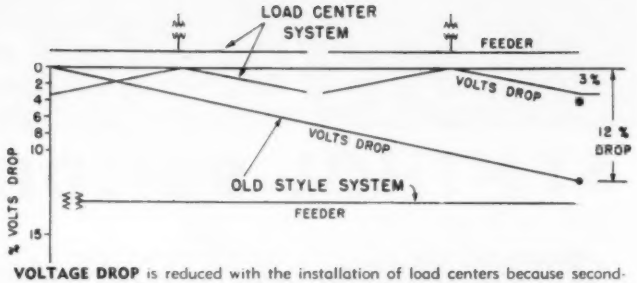


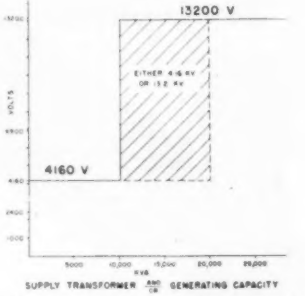
VOLTAGE DROP is reduced with the installation of load centers because secondary feeders are shortened. Load center drop rarely exceeds 3 percent, compared to drops as high as 20 percent with central substation systems where feeder lengths were considerably greater.

particularly in secondary circuits, to prevent unnecessary damage to electrical equipment and unnecessary stoppages of production. Only by the use of modern protective equipment which has the ability to open the most severe short circuit can we reduce the fatalities and financial loss caused by failure of inadequate short-circuit protective equipment. Since little publicity is given to industrial accidents, the failure of inadequate switching equipment is not stressed as it should be. Yet, in one state alone, where accurate reports are required of all industrial mishaps, over 80 cases of injuries and fatalities were reported in 1948 which were directly due to inadequately fused knife switches and small circuit breakers. As management realizes that adequate protection is far less expensive than insurance claims and lost man-hours, short-circuit equipment will be readily endorsed and installed.

Higher Secondary Voltages

The trend towards the use of higher voltages will continue. More and more plants are adopting 480- instead of 240-volt secondary systems because 480-volt systems have from 25% to 50% lower losses and greater flexibility. In fact, many plants are now actually modernizing by changing from 240- to 480-volt operation. On the other hand, 600-volt systems are not being generally adopted. For, although 600- is less expensive than 480-volt distribution, the lack of availability of 550-volt equipment in manufacturers' stock discourages 600-volt installations.

Primary voltages are following a trend towards 4160 volts for small and medium plants up to about 10,000-kva supply transformer capacity, and towards 13,200 volts for plants above 20,000-kva supply transformer capacity. These voltages are being adopted in preference to large 600- or 2400-volt systems for medium sized plants, and in place of 6900-volt systems for larger installations. Higher primary voltages mean lower costs, greater flexibility and greater margin for expansion.



460 VOLTS HAS LOWER COST (25%) LOWER LOSSES, LESS VOLTAGE DROP, GREATER FLEXIBILITY THAN 230 VOLTS (IN THE USUAL SYSTEM)

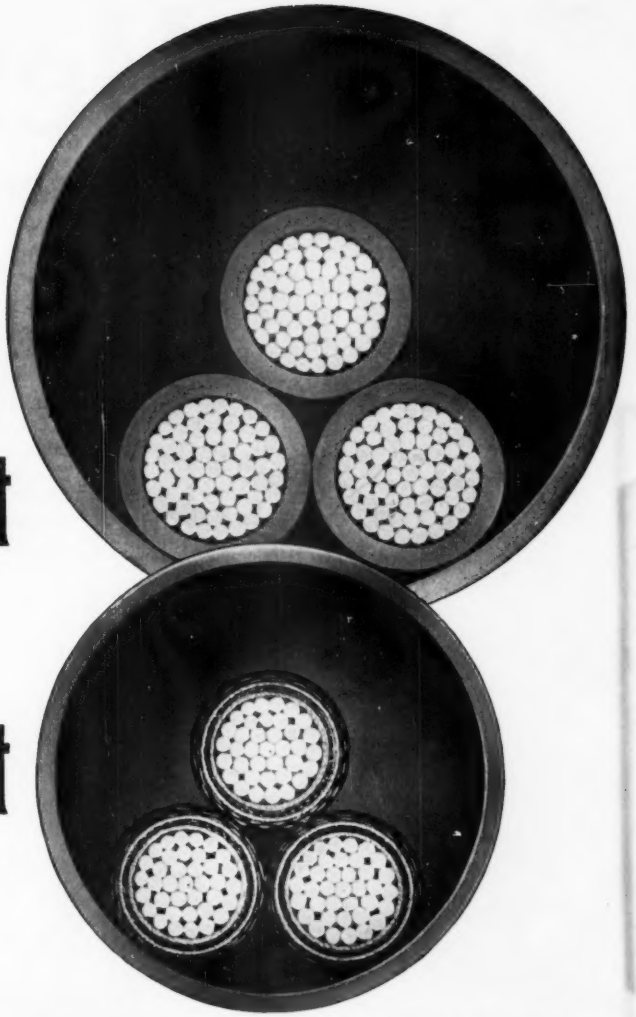
HIGHER VOLTAGES are being adopted for greater flexibility and lower costs. Modernization trends are towards 480 volts for secondary systems and to either 4160- or 13,200-volts for primary services. Higher voltages, combined with enclosed switchgear and busses, result in economy and safety.

The advantages of higher utilization voltages, coupled with enclosed substations, switchgear and bus, with all live parts encased in grounded metal, can thus combine economic profits with complete safety. While plants of a few hundred kva capacity, supplied at low voltage directly from utility service lines, do not encounter all of these problems, they can nevertheless provide distribution flexibility and safety by installing plug-in bus ducts and adequate interrupting switchgear.

Modernization Program

Since modernization should be considered when ever a plant addition or production line change occurs, it is encouraging to observe the growing attention directed to this important subject. While numerous examples could be cited to emphasize this point, just one will be mentioned briefly for illustrative purposes.

Why Buy 4" Conduit when 3" Conduit will do?



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FREE SALES KIT. Contains four "See Better . . . Work Better" sales tools: (1) Sixteen page book that sells the "See Better . . . Work Better" idea; (2) Forty-four page book of industrial lighting examples; (3) Pocket-size "Industrial 50 ft-c Estimator"; (4) Pocket size lighting survey sheet.

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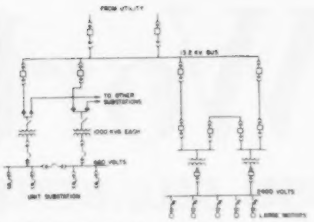

MODERNIZATION of a recent metal-working factory by installing a new 2400-volt master substation and new 480-volt load centers resulted in a 10-percent reduction of first costs, a 90-percent reduction in voltage drop and the provision for future expansion.

A metal-working factory, with metal-clad switchgear less than 10 years old, received primary utility service at 13.2-kv. Utilization voltage was 480. However, 13.2-kv/480-volt substations were very large, switchgear was inadequate and in poor condition, the congested area around the oil-filled transformers constituted a fire hazard, and the voltage drop in the system was 20%, causing many operating difficulties. To modernize, a new 2400-volt master substation and new 480-volt load center subs were installed. The result was a 10% reduction in first costs, voltage drop was cut from 20% to 2% maximum, expansion facilities for future loads were provided, and new 200-hp. 2300-volt motors could be connected directly to 2400-volt switchgear. This changeover was made on a step-by-step basis, installing a few unit substations each year until the program was completed.

System Grounding

There is considerable interest in grounding neutrals of all classes of systems from 120 volts clear up to 287-kv. The practice of grounding 480-volt power systems is an outgrowth of the last war, where large aircraft plants had tremendous fluorescent lighting loads. It was found, by using 264-volt ballasts, that hundreds of tons of copper could be saved, compared with 120-volt operation. In addition, the dollar savings were sizable. Power supply for these lamps was 480Y/277, with neutrals grounded. Those who thought that results would be poor were surprised to note reduced maintenance, improved service reliability, and greater safety. Since then, such installations serve many thousands of kva load, and operators are so pleased with these 480-volt wye systems that their return to delta operation is very doubtful With systems having grounded neutrals, faulty motors are tripped instantly, and surges of overvoltage are suppressed to moderate values.

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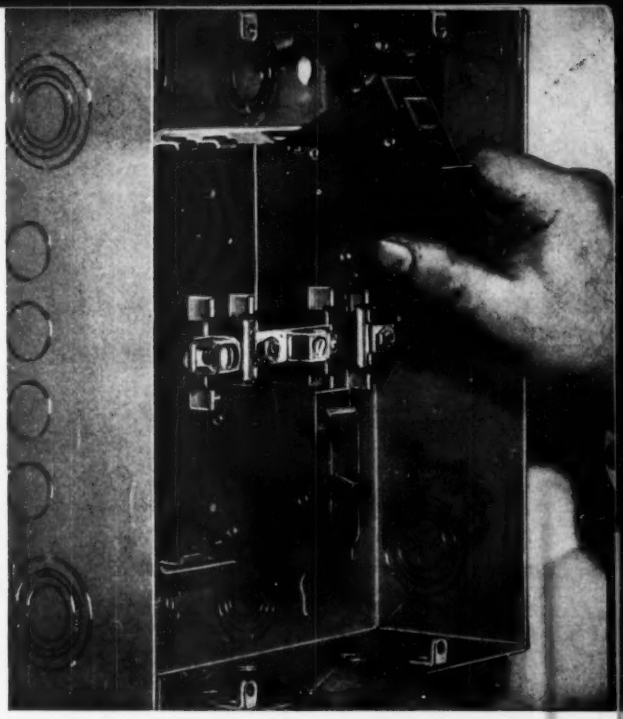

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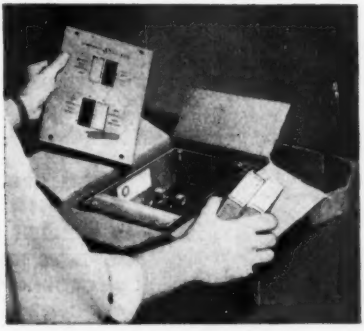

TWO BREAKERS PACKED along with enclosure and interior. Sufficient space is left to include a front and additional breakers. The fronts and additional breakers are individually packaged and stocked separately to suit individual customer's requirement.

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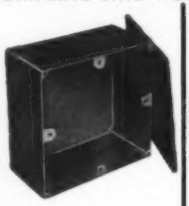

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Unflanged junction box with cover. Flush or Surface mounting.

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Weatherproof pull box. Complete with one-piece rubber gasket and hinged cover; surface mounting.

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Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.

and

Answered by
GLENN ROWELL
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

and

B. A. McDONALD
Chief Inspector
New York Board of Fire Underwriters
Rochester, N.Y.

Questions on the Code

Low Voltage Switching

Q. *We have found that it is now possible to obtain from the surplus market a field wire made for the armed forces which contains three No. 27 copper conductors and four or five steel conductors of the same size. Would it be possible to utilize this field wire as a type of thermostat wire for low voltage control switching?*—P.H.

A. It is assumed you have reference to the low voltage switches utilizing 24 or 25 volts supplied by a current limiting type transformer which has a maximum output capacity of one ampere at this voltage. If this is the case, you are concerned with what is known as a Class 2 remote control wiring installation, and you will find that Sections 7291 through 7293, which cover the wiring installation of a Class 2 remote control system, make no reference whatsoever to the type of wire which shall be used other than to state under Section 7292 that the conductors on the load side shall be insulated, shall be separated from other conductors of electric light and power circuits by a metallic barrier if placed in raceways or by two inches if in the open. Inasmuch as three No. 27 copper conductors have a total circular mil area somewhat comparable of a single No. 22 conductor, this type of wire will provide greater resistance to the flow of current than the usual No. 18 thermostat wire and therefore will make necessary a definite limitation on the length of a circuit comprised of such wire. The use of this wire would therefore not be a violation of the National Electrical Code. However, we would not recommend any runs of excessive length.—G.R.

Electrical Metallic Tubing

Q. *Please explain why Size O is largest sige conductor permitted in electrical metallic tubing. Is the relationship of weight or amperage the determining factor?*—M.N.

A. The Code requirement which limited the largest size conductor in electrical metallic tubing to one naught was eliminated in the 1946 Code. As a result, the maximum size conductor now permitted is governed by the maximum size of tubing permitted which is two inches. Since the size and number of conductors in EMT is covered by the Tables under Chapter 10 of the Code, you will find under Table No. 4 that the Code recognizes two number four naught conductors in 2 inch tubing. As I recall the development in the use of EMT, it appears that the important consideration which limited the size of conductor in EMT concerned the conductivity of the thin wall tubing, with fittings which were difficult to keep tight, to safely carry fault currents and permit overcurrent devices protecting the conductor to operate when such faults occurred. This opinion is verified by our present day Code, under the Table in Section 2594-b. This rule covers the grounding of service equipment and the Table shows that for service conductors larger than No. 2 the size of EMT required for grounding such service equipment is approximately twice the size of conduit required.—B.A.McD.

Overheated Switches And Fuse Enclosures

Q. *Since overload devices, such as fused switches and circuit breakers, overheat inside enclosures, when carrying full load, would it be wise for architects and electrical engineers and contractors to limit the load on any overload device to not more than 60% of rated load? Underwriters ratings are based on tests in free air.* —*G.F.*

A. In order to answer this question, I believe that we should review some of the characteristics of the devices used and the conditions under which they are used that promote the generation of heat.

One of the greatest causes for heat in a panel is the conventional fuse which operates when a circuit is overloaded by melting a metallic element such as zinc. The melting point of this metal is 784° F, which indicates that considerable heat is generated when a fuse is operating at or near its rated capacity. A few circuits in a panel, operating under such condition, will result in a very warm panel. This characteristic of a fuse appears to support your contention that the loads on such devices be limited to 60% and I believe this opinion is common with many engineers who desire an installation with considerable more adequacy than the minimum standard set up by the Code. The fact remains, however, that a new installation adequately designed may become seriously overloaded within a few years, due to incompetent maintenance which promotes the overloading of circuits and it is on this type of work that the Inspector ususally finds the overheated panels, switches and feeders. The time-delay type of fuse operates at a considerable lower temperature than the conventional fuse, about 300° F. This is about 500° F lower than the conventional fuses. The use of such fuses would result in lower temperatures in panel boxes and combination switch and fuse enclosures.

Another important consideration in this problem of overheating in switch and overcurrent enclosures, concerns the occupancy to be served. The problem of a war plant, operating at full load in all departments on three 8 hour shifts per day, is vastly different than a church, hospital or other occupancies where the demand for electricity is low and exists only for short periods of time. Most department or clothes stores operate for periods from nine to twelve hours a day at maximum lighting and power loads. Ordinary fuse and switch panels are not designed to serve such continuous loads without heating when the circuits are loaded within approximately 60% of their capacity. This proven fact again justifies your proposal for 60% loading of circuits. The fact remains, however, that if the engineer specifies panels so designed that the branch circuits may be loaded to capacity, overheating at such panels will be tempered to a safe degree.

Another condition which influences overheating of switch and fuse enclosures concerns the location of such equipments. If located where ambient temperatures are high, overheating usually will result. Poorly ventilated rooms or enclosures will produce the same results. Too often main services and feeder panels are located in boiler rooms where ambient temperatures are

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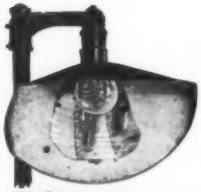

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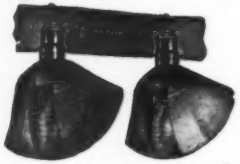

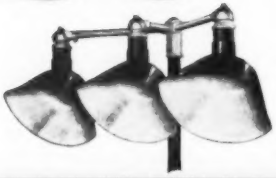

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high, due to poorly insulated boilers. Such conditions promote overheating irrespective of circuit loading.

Another condition which promotes overheating are poor terminal connections. A poorly soldered lug or a loose solderless connector will cause overheating and if not corrected promptly, will result in considerable damage to a costly switch or panel. This condition would not be influenced by circuit loading. It may be the result of poor workmanship, poor maintenance or poor designed fittings. Many other conditions enter into this problem of overheating; overloaded feeders, neglect to consider power factor of loads, magnetic heating in large switch enclosures. All of these conditions promote overheating.

In view of this brief review of this problem, I am inclined to agree with your proposal to limit circuit loading to 60% on lighting and appliance loads but I trust I have covered other important features which concern design, workmanship and maintenance that also have a large influence on the overheating of switch and overcurrent device enclosures.—B.A.McD.

Electronic Control Equipment

Q. *We are installing some electronic control equipment for the control of a bake oven which will contain highly explosive vapors during its normal use and inasmuch as currents having values as high as 80 milliamperes may be employed on some of the circuits for these instruments, will it be necessary that such circuits be contained within explosion-proof fittings and conduits or are such currents of sufficiently low value to be unable to produce a spark which might cause explosive vapors to ignite? We have been led to believe by several different individuals that the current values on these circuits are so small they cannot form a spark of sufficient intensity to cause ignition.*—A.P.B.

A. At the present time there is no complete data available relative to the spark intensity necessary to cause explosions or ignition of various types and mixtures of explosive vapors or gases. A considerable amount of activity is underway in both this country and in England in an attempt to arrive at definite figures concerning voltage and amperage of such currents. However, so far all we know is that there are many variables which enter this field that have direct bearing on the intensity of a spark necessary to cause such ignition. Things such as drafts,

humidity and location within explosive range all have direct bearing on these values. For this reason the National Electrical Code under Section 5024 still requires that in a Class I, Division 1 location all apparatus, equipment of signalling, alarm, remote-control and communication systems, irrespective of voltage, be of the type approved for Class I locations, and that all wiring used in connection with such equipment be installed in conformance with paragraph a of Section 5014, and paragraphs a and c of Section 5015. These latter sections cover the use of conduit and seals such as is required for ordinary electric circuits in Class I, Division 1 locations.—G.R.

Figuring Motor Conductor Sizes

Q. *In figuring the size of conductors required for wiring a motor circuit, is it required by the Code to use the current rating of the motor given in the Tables 21 to 24 of the Code or may I use the nameplate current rating of the motor? I recently had a case where the nameplate current rating was less than the value shown in the Tables and smaller conductors and conduit could be used if this was permitted.*—D.W.

A. Section 4309 of the Code requires that the full load current values for motors given in Tables 21 to 24 be used in figuring the size of conductors to be used except for low speed or high torque motors which may require more running current. In these special cases, the nameplate rating of the motor must be used. This exception appears as a foot note following Tables 22 to 24. This rule enables the contractor in most cases to bid on motor wiring installations before nameplate ratings are available and compute the correct conductor and conduit sizes, which enables him to submit a bid, based on impartial information available to all.—B.A.McD.

Wiring for a Warehouse

Q. *I have been planning to bid on the wiring job in a rather large warehouse being erected in this city and upon receiving the wiring specifications, I find they call for 100 ampere service which actually is only about one-half that which would be required should we comply with the requirements of the local inspection authorities and utilize one-quarter watt per square foot for determining the size of the service and feeder conductors. In dis-*

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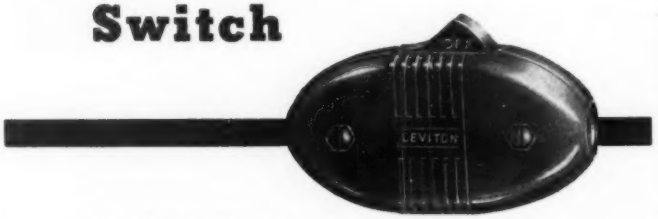

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cussing this with the building owners, they tell us 100 ampere service equipment is ample to supply the load which will be installed as nothing more than a 40 watt lamp will be used in any of the lamp outlets. Taking into consideration the use of only 40 watt lamps, they are undoubtedly correct in their assumption that 100 ampere service equipment is more than adequate. However, I shall appreciate receiving any help you can give me on this problem.—S.J.

A. There is no question but that Article 220 of the National Electrical Code will require that the feeder conductors supplying this warehouse building be determined by utilizing a unit load per square foot of ¼ watt and if application of the demand factor permitted of 50% for all load in excess of 12.500 watts still makes mandatory the use of a 200 ampere switch, compliance with the National Electrical Code will require the use of such a switch. While it is entirely possible that immediately following completion of this building the total connected load will be much less than the actual ability of the service to supply, it is also probable such condition will be very temporary as experience has indicated time and again that building services become inadequate much too soon.—G. R.

Electrical Metallic Tubing Used in Schools

Q. *Could you tell me if steel tube or thin wall conduit will pass inspection in a rural Class "A" school?* —K.K.

A. Insofar as the N. E. Code is concerned electrical metallic tubing in general is recognized as acceptable for wiring a school occupancy. Section 3482 of the Code covers this point. Since the ordinary school of today may include in addition to classrooms, such occupancies as a bus garage, an auditorium which might be classed as a theatre or a wood working shop which might be classed as a hazardous location, it is essential that the rules covering such occupancies be reviewed so that there will be no Code violations. Section 5131 and 5014-b covers the garage requirements and reference to these rules shows that the tubing may be used in this occupancy. Section 5211 of the Code covers wiring requirements for theater occupancies and reference to this rule shows that tubing may be used in this occupancy. Section 5073-a covers the wiring requirements in a wood working oc-

cupancy and reference to this rule shows that rigid metal conduit is the only wiring method recognized. There is, however, one important provision in Section 3482 which covers mechanical injury. This rule advises that electrical metallic tubing shall not be used where during installation or afterwards, it will be subject to serve mechanical injury.

In the absence of any local laws or requirements which conflict with the N. E. Code, electrical metallic tubing could be used for wiring school occupancy in line with the foregoing conditions, which must be considered. This point should be checked with the Inspection Authority having jurisdiction. —B.A.McD.

Minimum Size Service

Q. *What's this new rule about minimum No. 6 services? I wire electrically lighted advertising sign boards and usually install a 2 wire, No. 8 service. Does this new rule apply to such jobs?*—D.M.B.

A. The new Code requirement, Section 2304, requires minimum No. 6 service entrance conductors except for installations consisting of not more than two 2 wire branch circuits. In cases covered by this exception, the minimum service entrance conductors shall be No. 8. Reference to this Section 2304 also show some other special exceptions to this requirement. In the case you mention in your question, if the sign boards you wire require only two or less circuits, you may continue to use No. 8 service entrance conductors without any Code violation.—B.A.McD.

Drainage

Q. *Is it considered necessary to provide a drain in a conduit run which extends underground at a petroleum tank farm where the wiring is all explosion-proof Class I Group D?*—M.E.C.

A. The National Electrical Code under Section 5015, c. 5. states that where there is a possibility water or other condensed vapor may be trapped at any point in the raceway system, approved means shall be provided to prevent accumulation or to permit periodic draining of such water or condensed vapor. While that is undoubtedly a justifiable ruling, it does not prove to be practical in areas subject to freezing weather during winter months with the result that some inspection

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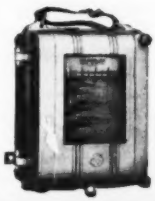

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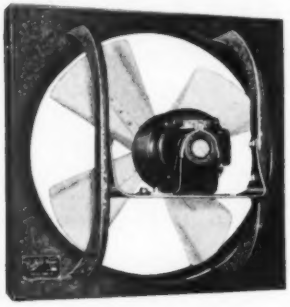

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authorities disagree with the Code as they feel a fitting drain is more likely to permit entrance of moisture in an underground run than no drain and inasmuch as the great majority of bulk stations and tank farms do not have in their employ competent maintenance personnel to periodically drain off accumulations of moisture or condensed vapors, conduit runs without drains between sealing fittings are being accepted. Furthermore, the development of a new nylon jacketed conductor designed especially for use where gasoline vapors or liquid is present has greatly increased the life expectancy of electrical circuits installed in such locations. It is therefore suggested that prior to making installations of electrical conduits on this type of property you contact the inspector having jurisdiction and reach an agreement with him prior to actual installation as both climatic and soil conditions have a most direct bearing on this ruling in the Code and the necessity of enforcing it. —G.R.

Motors Rated in Amperes

Q. *When the rating of a motor is given in amperes at a certain voltage, how do you figure the hp rating of such a motor?*—R.T.

A. The Code definitely covers your question under Section 4309. This rule advises that the hp rating of a motor whose nameplate only gives the ampere rating, shall be assumed to be that corresponding to the value given in Tables 21 to 24, prorated if necessary. As an example, a three phase ac induction type squirrel cage 220 volt motor with a nameplate reading of 15 amperes, would be a 5 hp motor, or a motor of similar characteristics with a nameplate rating of 91 amperes would be a 35 hp motor.—B.A.McD.

Bare Bus

Q. *Because of some building remodeling which is now underway, we have been asked to make a change on some enclosed bare bus between two switchboards in an industrial plant in this city. This bus is carrying approximately 1,000 amperes at 440 volts and we understand we must use 2 by ¼ inch copper bar to fabricate a small U section necessary to fit around a beam now being installed in this building. If this section is fabricated without insulation plates between the bus, what spacing must we provide to comply with the Code?*

A. You will find under Section 3747 that the minimum clearance between bare current carrying metal parts of opposite polarities mounted on the same surface shall be not less than 2 inches, nor less than one inch for parts that are held free in the air. A spacing not less than one inch shall be secured between bare current carrying metal parts and any metal surface. Inasmuch as you have stated these bare bus extend between two panelboards, it is assumed you are revamping an auxiliary gutter and not a regular busway. Furthermore, as this revamping will consist of the assembly of a U shaped section, it will be well to pay particular attention to the problem of expansion and contraction so that pressure exerted at the top of each U member will not cause a change in the clearance requirements between the current conducting copper or the metallic enclosure for the gutter.—G.R.

Transformers on Roofs

Q. *I would like to install three 50 kva, 5,000-volt, oil filled transformers on the roof of a fire resistive building. Is there any Code violation? What rule applies?*—W.C.

A. According to the 1940 N. E. Code, transformers immersed in a liquid that will burn, if installed on the roof of a building, had to be installed in a transformer vault. When the 1946 Code was issued, this provision was entirely deleted. As a result, since 1946 there has been no definite provision for high voltage transformers placed on the roof of a building. In other words, the Code does not say that you may or may not place such transformers on roofs. The only rule which appears to apply is Section 4524 and if the requirements of this rule are satisfied, I see no Code violation in installing oil filled transformers on roofs of buildings.

One of the principal requirements of this rule is to safeguard from fire, any combustible materials or structures which may be in the vicinity of the transformers. In the case you mention of a fire resistive building, it appears that if the transformers are mounted of a concrete base provided with curbs not less than 4 inches high and if practicable drained, and that the transformers are enclosed by a wire grill to prevent accidental contact with high voltage, there would be no Code violation. Section 4524 of the 1951 Code has been completely rewritten and I suggest that you study this rule so that you may assure yourself that all of the requirements will be satisfied. —B.A.McD.

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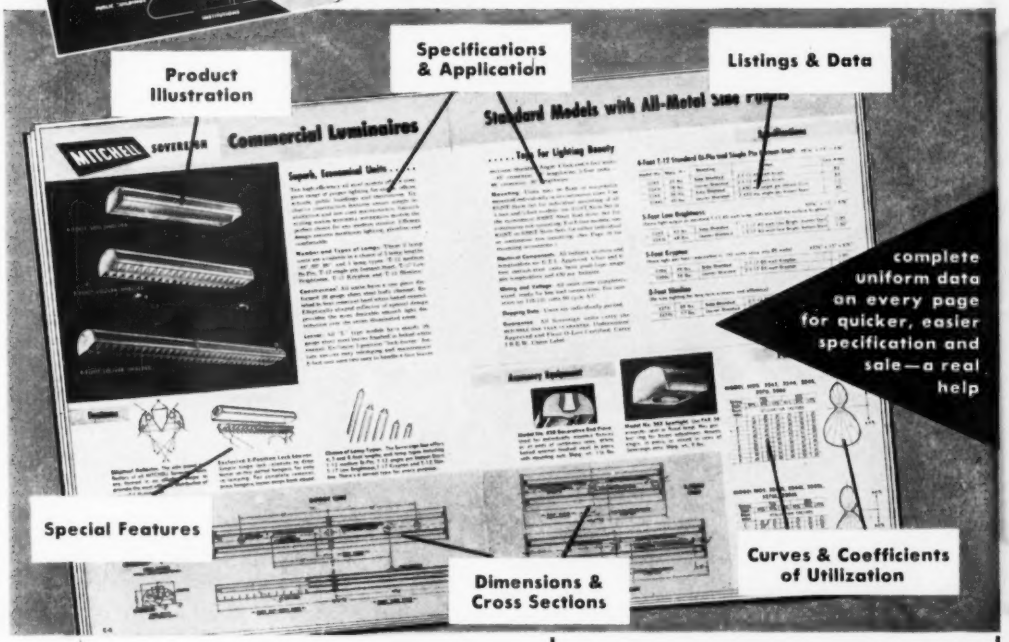
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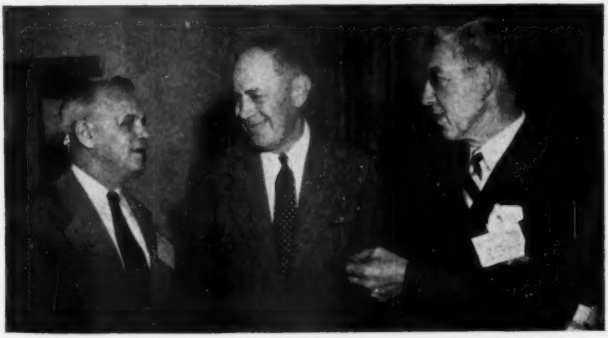
In The News

Washington Host To IES Conference

The Illuminating Engineering Society held its 43rd National Technical Conference in Washington, D. C. on August 27-30, 1951, at the Shoreham Hotel. Over 800 members, wives and guests were registered for this four-day event, for which the IES Capital Section was host.

A broad array of technical and special sessions, and an outstanding and interesting program of entertainment contributed to a well-rounded and busy conference program. It included almost fifty technical papers, a review of the year's progress in the art of illuminating engineering, an educational-entertainment type Lighting Service Forum, special entertainment throughout the four days for the ladies and teen-agers, and other sports and entertainment features. An IES President's reception, banquet, and dance on the last evening of the Conference terminated the annual affair.



WELCOMING IES to Washington in August was R. Roy Dunn (center), President, Potomac Electric Power Co., Washington. Walter Sturrock (L), illuminating engineer, G. E. Co., Nela Park, and IES President 1950-51, and Samuel G. Hibben, Director of Applied Lighting, Westinghouse Electric Corp., the succeeding IES President, accept Mr. Dunn's greetings and discuss Conference acitvities.

LIGHTING ENGINEERS enjoying the IES National Technical Conference in Washington August 27-30 were (L to R): Denny C. Freeman, Buildings Management Div. of G. S. A.; Lee E. Tayler, Detroit Edison Co. and past-President of IES; Harry Grattan, Jr., Potomac Electric Power Co., chairman of the Attendance and Publicity Committee of the Conference, and past-Regional Vice President, IES; and Clarence W. Clarkson, Corning Glass Works, Chicago, Ill.

Opening Session

The Conference opened with an address of welcome by R. Roy Dunn, President, Potomac Electric Power Co. of Washington. General Secretary A. H. Manwaring, Philadelphia Electrical & Mfg. Co., then presented the annual report. Session Chairman, R. F. Hartenstein, of Ohio Edison Co., Akron, then introduced Walter Sturrock, President of the Illuminating Engineering Society, who presented the annual President's Address. He told of Society activities during the past fiscal year, discussed past aims and objectives, and concluded with recommendations for future activities of the Society.

Samuel G. Hibben, new President of IES for the 1951-1952 fiscal year, was next speaker. In discussing the IES in 1951-52, Mr. Hibben said the Society has "one fundamental obligation—to provide mankind with better see-ability," and stressed the continuation and re-emphasis of the studies of human vision.

A. A. Brainerd, Philadelphia Electric Co., illuminating engineer and President of the U. S. National Committee, International Commission on Illumination, presented highlights of the I. C. I. meetings held in Stockholm during the summer (E.C. and M., Sept., 1951, page 162).

W. R. Brode, National Bureau of Standards, concluded the opening session with a talk outlining the function and operation of the National Bureau of Standards and the work it does in illuminating engineering.

Presentation of 47 technical papers by various members, physicists, researchers and others made necessary parallel sessions. These were divided according to subject material, and in addition to general sessions, included sessions in light sources, aviation lighting, glare and comfort, street lighting, government buildings lighting, and residence lighting. The Residence Lighting Forum of the Society also held a general session.

General—Subjects covered in the general sessions ranged the field of engineering, design, testing, maintenance, cost analysis, and various related subjects.

A uniform method for making a lighting cost analysis, using basic data, initial costs, annual operating costs, and total annual costs, was proposed by A. C. Barr and C. L. Amick, General Electric Co., Nela Park.

Research into the field of energy consumed in the job of seeing, using a critical industrial task, led to the conclusion that 1200 footcandles was a desirable intensity for this one task, it was reported by Willard Allphin, Sylvania Electric Products, Inc., Salem, Mass.

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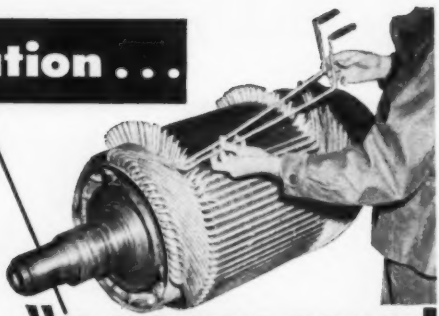

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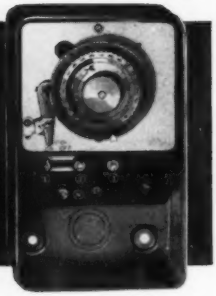

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direct illumination from linear light sources was outlined by R. G. McPhail of Holophane Co., Inc., New York City. Also, a report was given showing newly developed coefficients of illumination for luminaires with concentrating distributions, by J. R. Jones and John J. Neidhart, Westinghouse Electric Corp., Bloomfield, New Jersey and Cleveland, Ohio respectively.

Other papers covered such subjects as object-color changes from daylight to incandescent filament illumination, glass block penestration and the interflection method, floodlights at work, description of a new laboratory designed to facilitate production of required new lighting design data, relation of distance to candlepower distribution from fluorescent luminaires, fluorescent lamp performance on sequence-start ballasts, noise in gaseous discharge lamps, and several others.

Authors of one paper on industrial lighting maintenance concluded that light loss may be as much as 50 per cent in production areas, that plant owners simply are not aware of this fact, and that systematic cleaning of the lighting equipment will help increase production for war and civilian needs. Authors were C. E. Egeler and R. F. Vandenborn, G. E. Co., Nela Park. Fred J. Vorlander, Champion Lamp Works, Lynn, Mass., proposed group replacement of lamps as one economic solution to better maintenance, in a paper in which formulas and charts gave supporting data.

Light Sources—Five papers were devoted to various problems and developments relating to light sources. Color correction of mercury vapor lamps produced by phosphor coating, and new design and production features which have greatly improved these lamps, were reported by H. D. Fraser and W. S. Till, Westinghouse Electric Corp., Bloomfield. Other subjects included factors affecting the performance of indicator lamps, low pressure mercury discharges, electrical design data for mercury vapor lamp circuits, and starting of fluorescent lamps at low ambient temperatures. Instant-start fluorescent lamps can be started at any low ambient temperature by providing the proper open circuit voltage, it was pointed out.

Aviation Lighting—Three papers were presented on aviation lighting. Visual problems in aircraft lighting were discussed by Fred R. Brown and David Alsher, Aeronautical Medical Equipment Laboratory, Naval Air Experimental Station, Philadelphia, and test methods used in experimentation were described. Visual aids for airport ground traffic control were discussed by Martin A. Warskow, Airport Engineering Division, the Port of New

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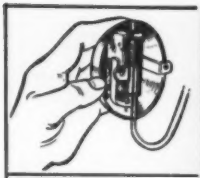

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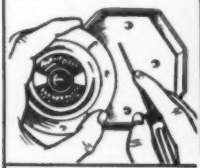

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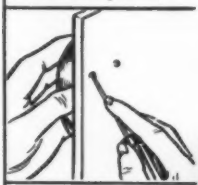

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LIGHTING PROBLEMS and how the U. S. National Bureau of Standards helps solve them were discussed by R. F. Hartenstein, IES National Technical Conference Committee chairman, E. W. Bride, Bureau of Standards, and George W. Clark, Conference Executive Committee chairman, during the IES National Technical Conference in Washington recently.

York Authority. The paper dealt with experiments, conducted at the New York International Airport, in connection with taxiway entrance signs and route marking signs. Results are still under study and further tests are being conducted, it was reported.

Present lighting aids are inadequate for private flying, it was reported by Robert C. Blatt, Associate Editor, *Electrical World*, summarizing a survey made among a group of 50 private flyers who have considerable night flying experience. Recommendations included a low cost ($500 or under) standard lighting system for the small private airport operators.

Glare and Comfort—Seven papers dealt with various phases of glare appraisal and relation of glare and comfort in lighting. S. K. Guth, G. E. Co., Nela Park, discussed "BCD Brightness Ratings in Lighting Practice," and H. L. Logan and A. Lange, Holophane Co., Inc., presented a paper on "The Evaluation of Visual Comfort Data." Other papers dealt with other phases of glare and lighting comfort research and appraisal, including one on street lighting and one on headlamp glare.

Street Lighting—Four papers dealt with street lighting problems. T. J. Seburn, City Traffic Engineer, Kansas City, Mo., discussed "Street Lighting —Traffic Accidents—Crime," and reported substantial decreases in accidents and crime in Kansas City after relighting. Other papers dealt with pavement surface reflectance measurements, brightness patterns from elongated light sources, etc.

Government Lighting—Three papers dealt with researches and practices in lighting within the government. Knox T. Hutchinson, Assistant Secretary of Agriculture, gave a paper on "U. S. Department of Agriculture's Researches with Light." L. M. Endres, Public Buildings Service, Washington,

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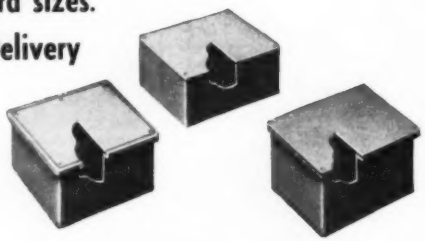

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CLEVELAND 11, OHIO

D. C., discussed light, color and environment in government offices, and reported increases in office workers' efficiencies in relighted and repainted offices. Thomas F. Coghlan, Public Buildings Service, Washington, D. C., reported on the lighting activities of the Public Buildings Services, and discussed the types of lighting equipment designs developed and specified by PBS for government buildings, and why these designs were developed and standardized for their use.

Residence Lighting—General room illumination in the home will now be put on an engineering basis, if the coefficient of utilization data presented by Priscilla Presbrey and Edith L. Buchholtz of Westinghouse Electric Corp., Bloomfield, N. J., are adopted. Other subjects covered included photography of residential artificial lighting effects, by E. W. Commery and T. Knowles, G. E. Co., Nela Park; proposed designs for lighting education in home economics colleges, by Kage A. Leighton, G. E. Co., Nela Park; and control aspects (wiring) of residence lighting, by Jan Reynolds, Sylvania Electric Products, Inc., New York.

Residence Lighting Forum—The Residence Lighting Forum of IES held a general session in which Forum progress was reported on, and various members of the Forum presented talks on various residence lighting progress. Myrtle Fahsbender, Westinghouse Electric Corp., Bloomfield, reported on home lighting in Europe as she saw it during her visit to the ICI session in Stockholm during the past summer.

Special Sessions

Three special sessions were held, each session being at night so that all delegates who desired could attend.

Alston Rodgers, G. E. Co., Nela Park, Chairman of the IES Committee on Progress, gave a dramatic stage presentation outlining the year's progressive lighting at home and abroad, with demonstrations and colored lantern slides.

The Lighting Service Forum, always held in conjunction with the National Conference and sponsored by the electrical utility lighting departments, put on a most interesting and entertaining program in the form of a skit. Through the staging of a "Congressional Investigation," simulating the Kefauver crime investigation committee, the Planned Lighting Program, the lighting industry, and the Illuminating Engineering Society, were "investigated." Delegates were "suppoenaed" to attend, some to testify.

The IES Coordinating Committee for National Defense sponsored a special session on "Military and Civil Defense Lighting." The activities of

this Committee were outlined by its Co-Chairman A. F. Wakefield, after which six military and civil defense speakers covered various phases of lighting for military and civil defense purposes.

A highlight of the entertainment for ladies attending the conference was a visit to Blair House, at which the Vice President's wife, Mrs. Barkley, was hostess. Other entertainment features included an Embassy tour, special ladies' luncheon, Washington tour, visit to the Washington Cathedral, and for all delegates, a boat ride down the Potomac River to Mt. Vernon, tour of Mt. Vernon, and the IES President's reception, banquet and dance.

Chairman of the National Conference Executive Committee was George W. Clark, Sylvania Electric Products, Inc.; Washington, D. C. Vice Chairman was Louis E. Barbrow, National Bureau of Standards; and Secretary was Harold V. Oerting, Potomac Electric Power Co., Washington.

How CMP Affects Home Building

The Housing and Home Finance Agency has issued a Questions and Answers bulletin, dated September 1, 1951, on "CMP as it Affects Home Building." Of the 29 questions asked and answered in this bulletin, one is considered of particular interest to the electrical industry. It is quoted in full below.

"*Question.* Under what conditions may construction proceed and materials be obtained by self-authorization?

"*Answer.* Self-authorized orders may be placed and filled, for delivery in the fourth quarter for materials not exceeding the following quantities per structure in the following types of structures:

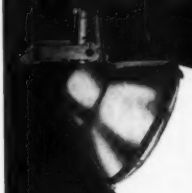
One-family residential structure
1,800 pounds of carbon steel, and 35 pounds of copper products, or 1,450 pounds of carbon steel, and 160 pounds of copper products

Two-family residential structure
3,500 pounds of carbon steel, and 65 pounds of copper products, or 2,700 pounds of carbon steel, and 300 pounds of copper products

Three-family residential structure
5,100 pounds of carbon steel, and 100 pounds of copper products, or 4,100 pounds of carbon steel, and 450 pounds of copper products

Four-family residential structure
6,500 pounds of carbon steel, and 125 pounds of copper products, or 5,200 pounds of carbon steel, and 575 pounds of copper products.

FOR BETTER PLANT SAFETY LIGHTING



VERSATILE

STEBER

LIGHTING UNITS

MEET EVERY LIGHTING REQUIREMENT

Steberlites for PAR-38 and R-40 Lamps.

STEBERLITE
Spot and Floodlights

Steberlites are cast aluminum, weatherproof, completely wired, articulated units made for both medium and Mogul base lamps. They can be mounted on walls, poles, or directly to outlet boxes, either singly or in clusters up to 6. Because of their flexibility, easy installation, and long life, Steberlites are the logical, economical answer to hundreds of lighting problems. It will pay you to investigate Steberlites. Write for Bulletin 120 today.

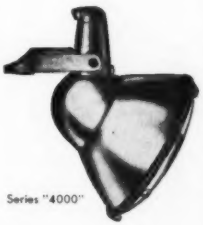
No. 57

No. 1600

STEBER FLOODLIGHTS FOR EFFICIENT AREA ILLUMINATION

Steber floodlights are especially adapted to safety lighting. They are easy to install and maintain, compact, flexible, rugged, weatherproof, and completely wired.

For small areas, open types No. 57 and 59 (100-300 watts), and enclosed types No. 572 and 592 (100-200 watts) are particularly suited. For larger areas and for lighting entrances, building fronts, etc., No. 1600 enclosed Floodlight with spun aluminum reflector is ideal. Uses 300-500 watt Mogul base lamps.



Series "4000"

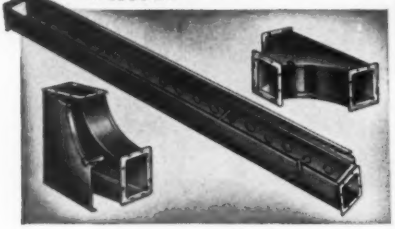
Series 4000 Aluminum Floodlight is designed for the efficient, economical illumination of all large areas including recreation fields, protective lighting of industrial plants, railroad yards, for lighting night construction projects, or for high intensity illumination in any application. Furnished in open or enclosed types, diffuse or specular alzak, with all standard mounting brackets. 750-1500 watts. Write for Bulletins 127-50 and 128-50.

Sold through Leading Wholesalers *Underwriters' Laboratories Approved*

STEBER

STEBER MANUFACTURING CO.
Dept. 98, Broadview (Maywood P .O.), Illinois

"NATURALS" for any wiring job!



KEYSTONE *Interchangeable* WIREWAYS and AUXILIARY FITTINGS!

Yes, there's extra profits for you . . . greater customer satisfaction, too . . . on every wiring installation made with KEYSTONE Interchangeable WireWays and auxiliary fittings. For the KEYSTONE line is the QUALITY line that gives you the basic flexibility of arrangement required to fit naturally into any electrical distribution layout. Provides permanent protection for main power lines . . . for feeders, branch circuits, control and signal wiring systems. Quickly, easily, neatly installed . . . saves time and labor as compared with piping and other improvised makeshift methods. And every item in the KEYSTONE line is fully approved by Underwriters to meet all code requirements.

KEYSTONE WireWays are available in Flanged or Flangeless types . . . with or without knockouts . . . in sizes of 2½" x 2½", 4" x 4", 4" x 6", and 6" x 6", and in foot lengths of 1' through 5' inclusive. Matching elbows, T fittings, hangers, brackets, collars, closing plates, and reducing bushings also available. Write for new "value-packed" catalog today!

• It pays to "figure on Keystone!"

NOW! Territories open for agents with warehouse facilities. Write for full particulars!

K KEYSTONE MANUFACTURING COMPANY
23328 Sherwood Ave. • Centerline (Detroit) Mich.
Sold Through Leading Electrical Wholesalers Coast-to-Coast

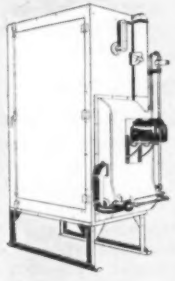
PROMINENT CONTRACTORS Harold A. Webster, T. Frederick Jackson, Inc., and Harry A. Fischbach, Fischbach & Moore, Inc., both from New York City, attended the recent convention of the New York State Association of Electrical Contractors and Dealers, Inc. at Saranac Inn, N.Y.

The authorized quantities of steel and copper are stated alternatively to allow the builder latitude in the choice of installing water systems using copper tubing or using steel piping. Thus, if the larger amounts of copper are required because of a copper-piping water system, the lesser amount of steel will be authorized, and vice-versa. No structural steel, no alloy or stainless steel, and no aluminum can be purchased for use in residential construction on a self-authorized order. Class B products are not included in the above weight limitations since they are not controlled materials."

Some preliminary studies indicate that the above copper weight restrictions are minimum for low cost housing, under $12,000, and of the type being sponsored by the Government under public appropriations. It is apparent that the amounts of copper permitted will not be adequate for wiring ranch-type houses, or for larger homes requiring four or more circuits for electrical utilization adequacy.

National Water Program Earmarks $3½ Million For Electrical Industry

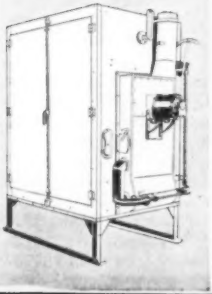
"The accumulated estimate for new construction and modernization of existing water facilities totals $12 billion; with about 10% planned for electrical apparatus and 20% for electrical labor." This estimate was voiced by H. R. Wallrath, manager of the General Electric Company's construction industries section, industrial division, on September 11th at the New York City premiere of G. E.'s new film, "Pipeline to the Clouds"—the latest



FANWAY OVENS a really complete line of higher quality finish baking ovens that every user can afford!

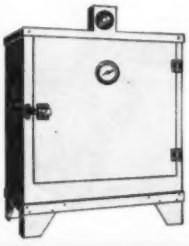
Available in five different sizes either gas or electric, these fine ovens have all of the features of units costing twice as much. Heavy sheet steel, double wall construction with rock wool insulation. Automatic temperature control and forced air re-circulation assures rapid, even, and correct drying of varnishes and paints.

We'll guarantee you can't buy better ovens at any price. Write for specifications and prices.



New—SMALL OVEN

This is the baby of the FANWAY family—a compact, sturdy unit for laboratory or small shop. Electric model only available in this size for 220 V., 60 cycle, with 2 K.W. heater element of special long lasting design. Inside over dimensions 18"x 18"x18". Weight 100 lbs. Stock No. TOV-OE only $125.00 net. Write for additional information on this and the larger models.



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"YOUR BEST SOURCE OF SUPPLY"

COMPLETE-READING ELECTRIC CO., INC.
100 SOUTH JEFFERSON ST. • CHICAGO 6, ILL.

presentation in the "More Power to America" series.

"Already, water supply is a mighty industry, with water utilities in the United States serving more than 100 million persons, delivering to them an average of 125 gallons per person per day, and with some 85,000 skilled water works men employed to run the industry," he said. "Yet it has become suddenly clear that our water supplies are limited, and the need for water is growing as our population grows and our industries develop."

W. V. O'Brien, G. E. commercial vice president, explained that the objective of the new program was to "make American communities aware of their need for adequate water-supply facilities. This, in turn, should logically result in a larger market for all electrical manufacturers and contractors, for the growing need is for more filters, power substations, electric switching equipment, electric motors and pumps, and automatic pumping stations."

NISA News

Los Angeles Chapter of NISA held their regular meeting on August 7th at Rodger Young Auditorium. Meeting was conducted by Chairman W. M. Hogue. Topic of discussion was MRO as certified under CMP Reg. No. 5 and No. 7 and its application to the electric repair business. The subject was very interesting; so much that there were many questions asked by the members. Thanks were offered the speaker by Mr. Backstrand of San Bernardino. Minutes of the meeting were taken by E. F. Swernhard, Secretary Treasurer of the Los Angeles Chapter.

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As a result of long periods of effort and study, employee training committee, under R. E. Ward, Sr., has developed with active participation of International Correspondence School a special program for electric motor repairman training, which is unique and fits the needs of the repair industry. Joe Previty is the new chairman of this committee. Fred B. Wipperman, Executive Secretary of NISA was elected Chairman of the St. Louis Week Committee of the Chamber of Commerce. Previously, for two years, he served as Chairman of the General Council of Civic Needs for the same city.

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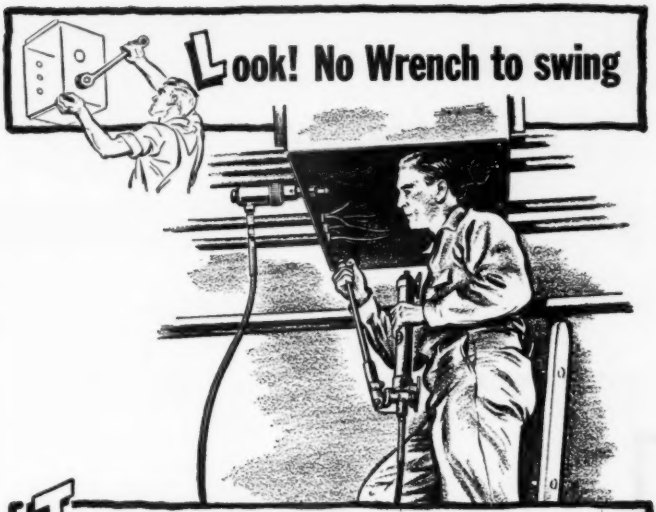
Southeastern Chapter recently had three meetings. Florida section had their meeting at the MacFadden Deauville Hotel, Miami Beach on July 28



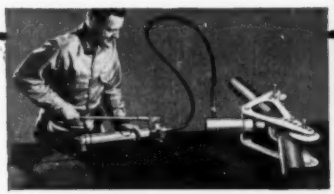
This HYDRAULIC Knock-out Punch Driver is 60% faster!

Drive knock-out punches with an amazingly low-cost "Porto-Power" hydraulic jack! A few easy strokes on the pump does it! Compare that with the old-fashioned method of a half-hundred knuckle-busting turns on a wrench. With "Porto-Power," you save on every hole punched — workmen are happier, safer — dies last 6 times longer — speed is spectacular! Pays for itself on the first good job!

A LOW-COST KIT FOR EVERY RANGE—

Blackhawk Knock-Out Punches and the hydraulic rams are available in complete kits serving ½" up to 2" and ½" up to 4½" openings. *Attention, owners of wrench-operated punches*: You can buy hydraulic equipment separately.

And big extra uses for hydraulic Porto-Power



Blackhawk electrician's equipment features famous "Porto-Power" hydraulic units. Unlike ordinary jack units, pump and ram are *separated* by a flexible hose. Ram is *all-directional* — much handier for hole punching, pipe bending and allied jobs. Low-cost Blackhawk Benders . . . today's No. 1 line — handle both rigid and thin-wall conduit better, faster.

CLIP COUPON for two helpful bulletins, 50-B and P-50. Buy from leading supply houses.

BLACKHAWK
HYDRAULIC *Porto-Power* EQUIPMENT

BLACKHAWK MFG. CO.
Dept. P20101, Milwaukee 1, Wis.
Please send me immediately your free Catalogs 50B and P-50 covering the full line of Blackhawk Electrician's Equipment.

Name .....
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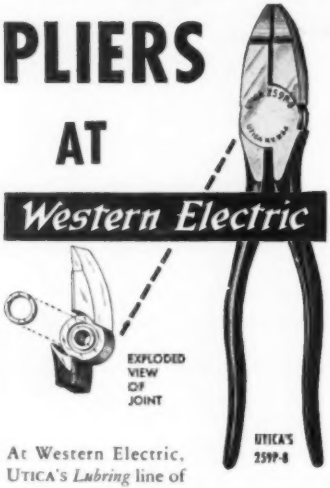
UTICA *LUBRING* PLIERS AT *Western Electric*



At Western Electric, UTICA'S *Lubring* line of pliers . . . with built-in lubrication . . . is used for a wide variety of in-plant and field jobs.

UTICA'S *Lubring* line of finest pliers has a ring of oil-impregnated porous iron floating in the joint . . . slowly feeding lubrication for smooth action, long life.

Drop forged, precision machined, with cutting edges hardened by a special UTICA process, the UTICA *Lubring* line has the heft, feel and rugged power for continuous daily use.

DROP FORGED FOR STRENGTH

The name UTICA on the pliers and adjustable wrench you use means you're working with the finest in drop forged tools. Drop forging aligns the steel fibre structure with the shape of the tool, as shown in diagram. Drop forging means *extra* strength, *extra* toughness.

UTICA Drop Forge & Tool Corp.
Utica 4, New York
In Canada:
Adam Tool & Supply Co., Ltd., Montreal
Wells-Irons, Ltd., Winnipeg

AND THE WORLD'S BEST TOOLS ARE MADE IN U. S. A.

and 29 with 25 members attending. Arthur Turner, Jr., Director from Florida, was presiding at this meeting. Larry Hartwick of the Russell Electric Company, Mobile, Alabama and Frank Spiegal of Brownell Distributors, Atlanta, Georgia, presented talks on Priority Regulations.

•

Hall Grey, Chapter President, held meeting at Columbia, South Carolina on August 4 with 21 members attending. Topic of talk was new 3% sales tax adopted by the state of South Carolina.

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Virginia director T. K. Preddy held meeting at Hotel John Marshall, Richmond, Virginia, with 19 members present. O. M. McCullough from the office of Price Stabilization gave a very interesting talk on Price Control, and Fred Shelor from National Production Authority discussed various phases of the many regulations pertaining to priority. Very interesting and novel feature of this meeting was the Shop Foreman Forum where their problems were presented and discussed.

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The Northern California Chapter met August 6th at the El Jardin Restaurant in San Francisco at which copper situation was discussed.

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New members who recently joined NISA: R. W. Oatman, Leesburg Armature Works, Leesburg, Fla.; Geo. Van Domlin, Van Domlin's Electric Motor & Armature Works, St. Petersburg, Florida; F. Streich, Streich Electric, Knox, Indiana; J. Farrell, Armor Electric Motor Repair, Buffalo, N. Y.

•

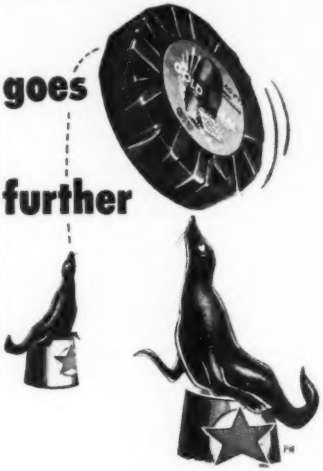
Central District Chapter of NISA on September 11th held meeting and dinner at Chicago Lighting Institute with a very interesting program, "The Miracle of Lights", conducted by the institute.

•

The following officers were re-elected in the New York Metropolitan Section of NISA for the current year: President, Stanley Bojak, Standard Electric Motor Repair, Linden, N. J.; Vice President, Alex. A. Shovan, Industrial Electrical Service, Hawthorne, N. J.; Treasurer, Wm. Kauppert, General Electrical Specialty Co., Hollis, N. Y.; Executive Secretary, L. J. Kennedy.

From Walter J. Prise, The Maintenance Company, Inc., N. Y. C.

Here's why JENKINS GOLD SEAL TAPE goes further



GUARANTEED FOOTAGE — you get full measure in every roll.

NO WASTE — Gold Seal Friction Tape tears evenly, does not ravel, conforms closely to uneven surfaces. Selected base cloth is made to high strength specification.

HIGH DIELECTRIC STRENGTH — Less footage is needed per job with Gold Seal Tape. No pinholes . . . one thickness insulates.

LASTING "TACK" — adhesive compound is prepared under laboratory control; this means that Gold Seal will stick to the job under severe conditions of cold and moisture.

EASY HANDLING — Gold Seal does not peel, dry out or smear the hands in hottest weather.

CELLOPHANE-WRAPPED — Keeps Gold Seal Tape factory-fresh until you're ready to use it.

PACKAGED FOR CONVENIENCE — In single rolls or handy 10-roll containers, it's the best buy in tapes. Jenkins Bros., (Rubber Division), 100 Park Ave., New York 17, New York.

JENKINS

Gold Seal Tape

FRICTION . . . RUBBER

MADE BY JENKINS BROS. . . . MAKERS OF FAMOUS JENKINS VALVES

SPEAKERS at convention of New York State Association of Electrical Contractors and Dealers at Saranac Inn, N. Y., were (left to right) Arthur L. Herbert, Long Island Lighting Co.; James W. Carpenter, Long Island Lighting Co.; James Kimball, Sperry Gyroscope Co.; and Franklin S. Koons, Long Island Lighting Co.

Officers Elected For NECA Carolinas Chapter

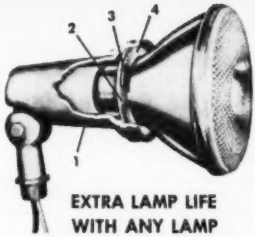
At the meeting of the Carolinas chapter of NECA at Fontana Village, N. C., the following officers were elected: W. C. McGregor, Anderson, S. C., president; Howard Pancoast, High Point, N. C., first vice-president; W. W. Hanks, Charlotte, N. C., secretary; Ralph K. Robinson, Charlotte, treasurer; J. C. Bolen, Charlotte, governor; W. C. Moseley, Charlotte, national counselor; and E. C. Peele, Burlington, national committeeman.

Manpower Commission Seeks Trained Engineers

A convocation of over 500 engineers, educators and industrialists was held by the Engineering Manpower Commission in Pittsburgh, Pa., September 28th, to discuss what must be done to maintain and increase the national supply of engineers needed for both civilian and armed service. The Commission, established by the Engineers Joint Council in response to a request from the Manpower Office of the National Security Resources Board, planned the crowded one-day program: (1) to emphasize the importance of the technical man to our way of life, (2) to promote the most effective utilization of engineers in the national interest, (3) to disseminate information on the required role of the engineer in our economy, and (4) to launch a long-range program to encourage qualified high school students to enter the field of engineering, and to have engineering students deferred (not excused) from military service so as to guarantee a future supply of engineering graduates.

NEW STONCO NO. 56 "SUPER SPOT"

100,000 CANDLEPOWER FOR ONLY 300 WATTS



EXTRA LAMP LIFE WITH ANY LAMP

New Stonco "Cushion-Seal" provides maximum lamp cooling and almost double the life you normally expect from PAR-38 or R-40 reflector lamps outdoors. Write for full details and new catalog material.

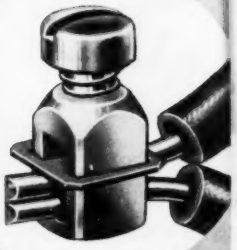
The most powerful 300-watt sealed-beam spotlight ever made. Long range, high intensity, oval-shaped beam that can be rotated to exact fixed position desired. Heavy-duty cast aluminum for outdoor, weather-proof service, completely enclosed wiring, adjustable swivel; fully UL approved. Write for catalog and illuminating data on this and other Stonco units—all with ½" standard mounting accessories for complete interchangeability.

STONCO ELECTRIC PRODUCTS CO.

485 HENRY STREET • ELIZABETH 4, N. J.

HANDY- EFFICIENT- ECONOMICAL!

BLACKBURN *Building Wire* **CONNECTORS**



Many Uses:

IN JUNCTION BOXES

FOR FIXTURE AND RANGE CONNECTIONS

FOR MOTOR CONNECTIONS

Quick and easy to install, yet connections can be changed without clipping pigtails. Only 3 sizes cover a range from No. 14 to No. 4 wires. Save labor—cost little—get some today.

How to Order:

Cat. 10U	for 2, 3 or 4 No. 14 wires	
" "	"	2 or 3 No. 12 wires
" "	"	2 No. 10 wires
" 6U	"	2 or 3 No. 8 wires
" "	"	2 No. 6 wires
" 4U	"	2 No. 6 or 2 No. 4 wires

JASPER BLACKBURN CORPORATION

38 MADISON ST.

ST. LOUIS 6, MO.

Phone CEntral 3007

Prest-O-Lite
Trade-Mark
5-in-1 Outfit

5-in-1 Precision Outfit . . . $22.50

Precision Flame Control for
SOLDERING, HEATING, BRAZING

An all 'round outfit—as easy to use on a pole or underground as in the shop . . . Four stems and soldering copper handle all soldering, heating, and brazing work . . . Needle valve control gives exact flame and heat for each job . . . Lights instantly at full heat regardless of drafts or weather . . . No pumping, priming, or generating . . . No smoke or fumes.

Ask your nearest "Prest-O-Lite" Jobber or write us for further details. Linde Air Products Company, a Division of Union Carbide and Carbon Corporation, 30 E. 42nd Street, New York 17, N. Y.

The term "Prest-O-Lite" is a registered trade-mark of Union Carbide and Carbon Corporation.

Order from your local Jobber

3 VALUES!

★ One-Piece Construction
★ Wide Wire Range
★ Economically Priced

BLACKBURN
Hi-Strength
TERMINAL LUGS

Strongly constructed—all in one piece—yet small and compact, to fit in tight quarters. UL approved.
Only 6 sizes cover a range from No. 14 to 1,000,000 CM.
Specify Blackburn and get a quality lug in the low price field.

JASPER BLACKBURN CORP., 35 Madison St., St. Louis 6, Mo., CEntral 3007

Power Transformers

An increase in allotment of controlled materials may be made to manufacturers of power and distribution transformers for the first quarter of 1952 production, members of this industry's NPA Advisory Committee were told by NPA officials at a recent meeting of the committee in Washington. Reason is that these heavy transformers are vital to military and defense supporting production, NPA explained.

NPA reported that this action will be taken even though there will be no appreciable increase in the supply of tight materials for some months ahead. Spokesmen said 20% of U. S. copper supplies are now imported, but that this total is currently not being delivered. Negotiations are under way to increase imports to this country during the first six months of next year.

The committee recommended that in order to assure equal distribution of available critical materials to the entire industry, the factor of usage during any given quarter be considered by NPA in authorizing allotments of controlled materials for the following quarter. NPA agreed to take the recommendation under advisement.

D. A. Griffith, of NPA's Electrical Equipment Division, presided.

High Interest In Merit Award Competition

Interest, among Owners and Users of outstanding lighting installations, in the $2500 Merit Award Competition sponsored by the Fourth International Lighting Exposition and Conference, is greater than ever, according to reports from G. T. Morrow, Chairman of the Merit Award Committee.

"Entries have been received," says Mr. Morrow, "from a wide variety of Owners and Users, covering installations in office buildings, retail stores, bank offices, automobile showrooms, service stations, schools, churches, industrial plants, airports, municipalities and recreational areas."

The special classification which permits an Owner or User to submit an entry on a lighting installation made between July 1, 1950 and December 31, 1951 was first incorporated in the Third International Lighting Exposition Merit Award Competition. Because of the record number of entries received from this group, it is again included in this competition as one of the major classifications. In addition to Owners and Users, others eligible to submit lighting case studies for Merit Awards or Gold Seal Merit Awards are electrical contractors, utility light-

ing and power representatives, electrical distributors' lighting specialists and salesmen, architects and consulting engineers.

Complete details, including information on how to enter, how to prepare entries, how the reports will be judged, etc., are available in the new Official Rules Brochure which includes the application blank. All requests should be directed to the Merit Award Committee, Fourth International Lighting Exposition, 326 West Madison Street, Room 818, Chicago 6, Illinois.

Specialty Transformers

At a recent meeting of the NPA Specialty Transformer Industry Advisory Committee, held in Washington under sponsorship of the Electrical Equipment Division, the committee told NPA that shortages of copper wire, silicon steel and carbon steel have lengthened delivery schedules for specialty transformers from 1-2 months before Korea to about 3-12 months now. A backlog of orders has become a bottleneck in the production of industrial furnaces, and can ultimately affect machine tool output, the manufacturers reported.

The committee members estimated that only about 5% of the total volume of specialty transformer manufacturers is non-essential to the defense mobilization effort.

One industry representative said his company will be able to fill only half its defense-rated orders because of the smallness of the fourth-quarter allotment of steel, copper and aluminum.

The serious September cut in copper-ore production caused by a miner's work stoppage in the United States, and a longshoremen's stoppage in Chile will sharply reduce output of wire-mill products in future months, NPA told the committee. There is little likelihood of a substantial increase in the copper supply, NPA officials reported.

NPA urged industry members to substitute aluminum wire for copper wire if it can be fitted into production lines. Members reported that they had already made some progress in substitutions along these lines.

Manufacturers emphasized the need to increase their production, pointing out that a 225% increase in machine tool output is expected by the end of 1952. It was pointed out that the lack of a small $25 specialty transformer can hold up delivery of a $50,000 machine tool.

George W. Cooper of NPA's Electrical Equipment Division, was Government Presiding Officer at this meeting.

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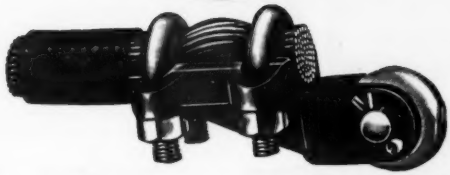

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CISC Has Adopted 10% Formula

Construction industry wage controls will not tie construction wages automatically to changes in the cost of living as the Wage Stabilization Board has done for other industries. Instead, the Construction Industry Stabilization Commission, with WSB approval, has adopted its own 10% formula.

Upon application, CISC will approve increases in construction industry area rates up to 10% above the area rate in effect on June 24, 1950, or on July 1 if agreed to before June 4. The 10% will not be increased before next January 1.

In special cases, CISC will approve, on a case basis, higher increases for manpower reasons or to correct inter-area or inter-craft wage inequisities.

Construction wages are stabilized by areas. Approved area rates will be announced by the Commission.

CISC decided that the January, 1951 base used by WSB for cost-of-living adjustments in other industries was inappropriate for construction because most construction wages are fixed in the Spring. The public, industry and labor members of CISC were unanimous in the new policy decision.

Exception to Taft-Hartley Law

An electrical contractor who is not a member of an association and does only $33,600 of business a year, only 10% of it outside the state, does not have enough impact on interstate commerce to warrant use of the Federal Taft-Hartley Labor Law in a labor dispute in which the contractor is involved.

This was the decision of the general counsel of the National Labor Relations Board in refusing to issue charges against the contractor requested by a former employee. The employee complained that the contractor violated the closed shop ban of Taft-Hartley when he dismissed the employee because he was not on a seniority list maintained by the contractor and a union.

Book Reviews

Mathematical Tables

A newly revised loose leaf data book containing tables and formulae needed to solve problems in arithmetic, geometry, algebra, trigonometry, analytical geometry and calculus is conveniently

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arranged in 6 thumb-indexed sections for ready reference. These sections cover mathematical reviews, squares, cubes, square roots, cube roots, reciprocals, areas and circumferences, 5-place logarithms of numbers and trig functions, natural trig and hyperbole functions. Priced at $1.50, the loose leaf book contains 176 pages. It is published by the Lefax Publishers, Philadelphia 7, Pa.

Manual Of UHF Installation and Maintenance

The latest booklet in the RCA electronic training series, titled "Ultra High Frequency Fundamentals," is a revision and expansion of an earlier presentation on Practical Analysis of UHF. It has been prepared as an aid for training, installation, operation and maintenance of UHF equipment, and serves as a source of introductory information and reference in the study of radio and radar principles applicable to the service and repair of military equipment. Published by the Government Service Division, RCA Service Company, Gloucester, N. J., the booklet is priced at 75 cents.

Maintenance Of Motors And Generators

For the primary use of maintenance men in the electrical industry, as a ready reference for the handling of everyday problems common to rotating machines, a new NEMA booklet titled "Protective Maintenance of Motors

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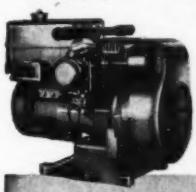

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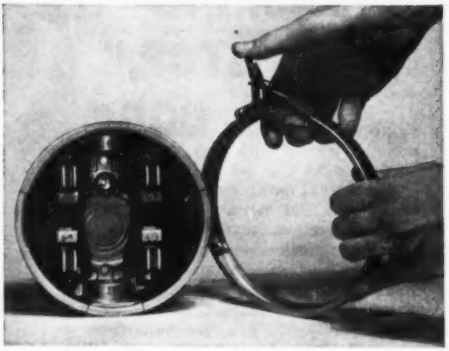

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For those who design, manufacture, buy or use induction machines, "The Nature of Polyphase Induction Machines" by Philip L. Alger will furnish the answers to such every-day questions as: How do you determine power factor, or secondary resistance and slip losses? What is the purpose of a rating system? How can normal friction and windage losses be corrected? What is the effect of skew on reactance? How do ventilation and temperature rise affect a machine? What are the cheapest methods of speed and torque control? How do you balance out magnetic noise? And what effects are produced by harmonic fields?

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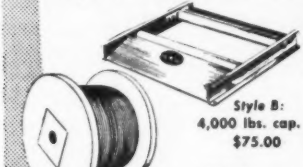

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Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N. Y., the book is priced at $7.50, has 397 pages sized 6 by 9¼ inches, and contains 128 illustrations.

AC Circuit Interruption

A concise presentation of the phenomena associated with the control and flow of current in electric circuits is offered under the title, "Fundamentals of AC Circuit Interruption," written by Dr. Erwin Salzer, consulting engineer for the Allis-Chalmers Manufacturing Co.

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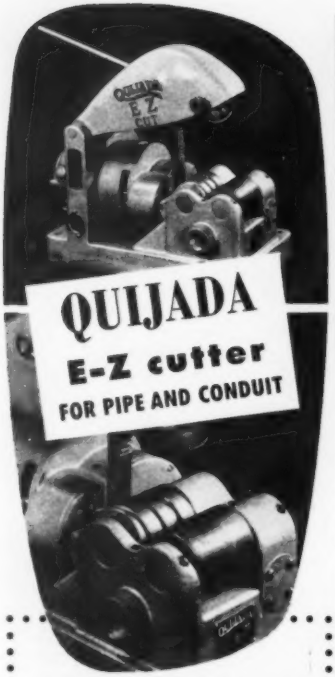

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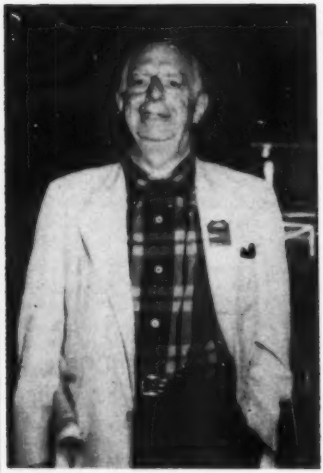

CHESTER WILLIAMS of Eastern States Electrical Contractors, Inc., New York City at recent convention of New York State Electrical Contractors and Dealers, Inc. at Saranac Inn, N. Y.

Among the Manufacturers

Headquarters Announcements

General Controls Co., Glendale, Calif. —Henry B. Safford, Jr., advertising and sales promotion manager.

RCA Victor, Camden, N. J.—M. J. Yahr, manager of the Sound Products Sales Group.

Sylvania Electric Products Inc., New York, N. Y.—Barton K. Wickstrum, vice-president and director of sales; Charles A. Burton, general sales manager of the lighting division at Salem, Mass.

Allis-Chalmers Company, Milwaukee, Wis.—C. B. Smith, manager of the service and erection section of the general machinery division.

General Electric Company, Schenectady, N. Y.—W. F. Rauber, special representative of the Large Apparatus Division in Washington, D. C.

General Electric Company, Philadelphia, Pa.—Clarence E. Burke, manager of sales of the Switchgear Department.

The Austin Company, Cleveland, Ohio.—A. D. Engle, assistant vice-president for engineering and research.

Corning Glass Works, Corning, N. Y. —John L. Hanigan, general manager of electrical products.

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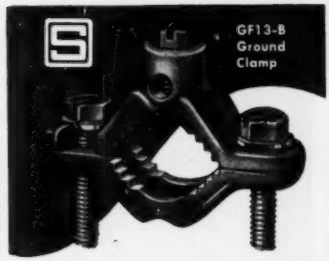

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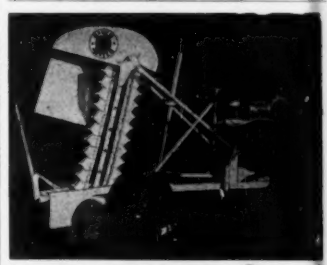

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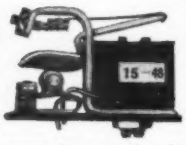


Standard relay is easily adjusted to different hp ratings . . . operates within 3 amperes and less variable current from any given high current point.

For All Capacitor Start Motors 1/6 to 5 HP

50-60 Cycles

Relay with protective cover can be internally or externally mounted.

IMMEDIATE DELIVERY FROM STOCK

Satisfaction Guaranteed

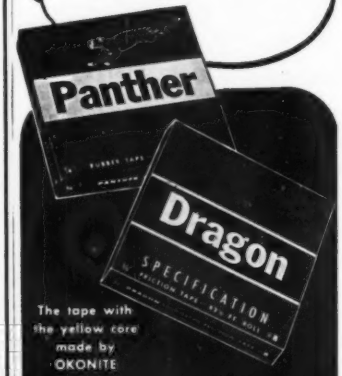
Write TODAY for descriptive bulletin

LEWUS ELECTRIC CO.

1254 W. Harrison St. Chicago 7

Phone SEeley 3-3756

"These tapes are really FRESH"



The tape with the yellow core made by OKONITE

SOLD ONLY THROUGH RECOGNIZED WHOLESALERS

Ask for them by name...

Panther and Dragon

friction and rubber tapes

Regional Appointments

NEW ENGLAND

General Electric Supply Corp.: E. L. Hall, Portland, Maine, manager of the Portland district (Maine, New Hampshire and Vermont).

MIDDLE ATLANTIC

Prevore Electric Mfg. Corp.: Harold Blumenstein, Philadelphia, Pa., sales representative for Middle Atlantic states.

Westinghouse Electric Corp.: George E. Grosser, Philadelphia, Pa., consulting and application engineering supervisor for Middle Atlantic district; Robert R. Longwell, Baltimore, Md., engineering and service manager.

SOUTH ATLANTIC

General Electric Company: C. E. Mighell, Nashville, Tenn., manager of major appliance sales in Nashville.

Allis-Chalmers Company: Columbia Electric Supply Co., Inc., Washington, D. C., distributor for Allis-Chalmers motors in the Washington area.

EAST CENTRAL

The Electric Products Co.: Harold J. Thompson, Chicago, Ill., representative.

General Electric Supply Corp.: George P. Roach, Terre Haute, Ind., manager of the Terre Haute house.

General Controls Company: Joseph Fallon, manager of the factory branch office in Columbus, Ohio.

General Electric Supply Corp.: W. A. Karrick, sales manager of supplies and apparatus for the Cincinnati, Ohio, district office.

Graybar Electric Company: W. G. Wehe, district operating manager at Detroit, Mich.

Wagner Electric Corp.: M. B. Atkinson, manager of Detroit office.

WEST CENTRAL

John A. Green Company: Bruce M. Williams, sales engineer for the states of Texas, Oklahoma, Louisiana, Arkansas and New Mexico.

Minnesota Mining and Mfg. Co.: Walter F. Gruetzman, manager of the regional sales office and warehouse in Dallas, Texas.

General Electric Supply Corp.: Charles T. Magruder, manager of the Cape Girardeau, Mo., house.

WEST

Royal Electric Co., Inc.: Harry F. Ream, Denver, Colo., representative for Colorado, Utah, Wyoming and parts of Nebraska, Idaho and Montana.

Wagner Electric Corp.: A. W. Maas, manager of the San Francisco, Calif., electrical office.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT: BUSINESS: **"OPPORTUNITIES"** :EQUIPMENT :USED OR RESALE

UNDISPLAYED —RATES— **DISPLAYED**

$1.20 per line, minimum 3 lines. To figure advance payment count 5 average words as a line. *Position Wanted and Individual Selling Opportunity* undisplayed rate is one-half of above rate, payable in advance.

Box Numbers in care of our New York, Chicago & San Francisco offices count as one additional line.

Discount of 10% if full payment is made in advance for 4 consecutiv insertions.

Equipment Wanted or For Sale Advertisements acceptable only in Displayed Style.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $11.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An Advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

New Ads Received by October 25th at the New York office, 330 W. 42nd St., New York 18, N. Y., will appear in the November Issue subject to limitations of space available. E.C.M

Opportunity for

PLANT ENGINEER

electrical wire and cable plant located in New Jersey

Applicant's background should include an engineering degree, experience in machine design and in plant maintenance.

Previous experience in a plant manufacturing insulated electrical wire and cable will attract special interest.

Write stating age, education, experience and salary desired.

Address:

P-1948, ELECTRICAL CONSTRUCTION & MAINTENANCE
330 W. 42 St., New York 18, N. Y.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITION WANTED

ELECTRICAL ENGINEER — Experienced in Project Engineering, Design, Contact, Estimating, Supervision, Coordinating, Construction work. PW-2026, Elec. Const. & Main.

ELECTRICAL PROJECT Engineer-(Construction). Age 41, B.S.—E.E. Ten years experience. Available November 1, 1951. PW-1721, Electrical Cons. & M.

SELLING OPPORTUNITY WANTED

WELL ESTABLISHED Manufacturers' Agency. Very thorough coverage Northern Ohio. Located in Cleveland. Interested in adding good line. Reply RA-2025, Elec. Const. & Main.

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Reg. Patent Attorney
1234 Broadway, New York 1, N. Y.

WANTED

BUYERS OF SURPLUS COPPER INSULATED WIRES AND CABLES
No lengths too long or too short
Telephone: Eastgate 7-4778
PIERCE CABLE CO.
2664 Clybourn Ave. Chicago 14, Illinois

NEW
Guaranteed Rebuilt
MOTORS-GENERATORS-CONTROLS
NOW IN STOCK
We buy surplus equipment
L.J. LAND Inc.
Box 756 Reading-4 Pa.

ELECTRICAL CABLE
- for every industrial and power application.
- Special constructions. Odd lengths.
- Large stocks on hand of high voltage, lead covered cables not ordinarily stocked by your regular suppliers.
- Cut to length. Reasonably priced.

UNIVERSAL Wire and Cable Co.
2664 N. Clybourn Ave. Chicago 14, Ill.

MOTORS, GENERATORS, TRANSFORMERS
1—1500 H. P.
Bought and Sold
New and Rebuilt
ELECTRIC EQUIPMENT CO

BOOKS

ELECTRICAL CONTRACTORS ESTIMATING HANDBOOK
"A Unique Tool of the Trade"
WRITE FOR DESCRIPTIVE FOLDER TO
THE ESTIMATOR PUBLISHING CO.
4102 Wilson Road Kenosha, Wis.

WHERE TO BUY

Equipment, Materials, Supplies and Services for Electrical Construction—Maintenance—Repairs

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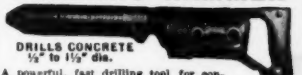
The Improved Wodack "Do-All"
ELECTRIC HAMMER

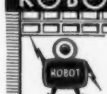


DRILLS CONCRETE ½" to 1½" dia.

A powerful, fast drilling tool for contractors, installers and maintenance departments. Separate the two members and it's a heavy duty ¾" electric drill. TWO TOOLS IN ONE. Star drills in 20 diameters and 20 other hammer tools for doing many kinds of work. Saves man hours. Speeds up work—12 to 15 times faster than hand drilling. Ask for Bulletin 510-EC.

Wodack Electric Tool Corporation
4627 W. Huron St. Chicago 44, Ill.

ROBOT OPERATORS



Electronically
OPEN — CLOSE — LOCK
DOORS • GATES • ETC.
Write for Catalog—Dept. CE
ROBOT APPLIANCES, INC.
13165 Prospect—Dearborn, Mich.

- BRILLIANT, UNIFORM LIGHT for all close work; assembly of small parts
- VARIABLE SIZE SPOT of LIGHT for wide range of inspection operations
- ADJUSTABLE to ANY POSITION, directs light into inaccessible places, at any angle. *Send for FREE Brochure*

DEALERS: Some choice territories still open.

Dept. C **LINDLY & CO.** 80 Herricks Rd., Mineola, N. Y.

A GOOD Habit

The Where-to-Buy Section of Electrical Construction and Maintenance supplements other advertising in this issue with these additional announcements of products and materials of special interest and application in the field of electrical construction, maintenance and repair work. Make a habit of checking this page each issue—a *good* habit!

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(Classified Advertising)

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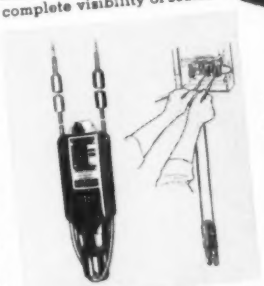
feature for feature...

THIS NEW SQUARE D VOLTAGE TESTER *Tops them ALL!*

MAGNETIC POLARITY CAP FOR INDICATION OF POLARITY OF D.C. SYSTEMS
PLAINLY MARKED, EASY TO READ, COLORED ETCHED SCALE—VISIBLE UNDER ALL LIGHT CONDITIONS
OPEN FACE "NO FOG" WINDOW FOR VOLTAGE INDICATION
NEW, MODERN DESIGN PLASTIC CASE WITHSTANDS 10,000 VOLTS
30" HEAVY DUTY OIL-RESISTING RUBBER LEADS WITH SHARP STEEL-TIPPED INSULATED PRODS
"RUBBER PANTS" PROTECT LEAD CONNECTIONS TO TESTER
110
220
125
250
440
550
600
D.C. POLARITY TEST
SQUARE D COMPANY

Plastic case designed to completely house prods when tester is not in use.

Two-hand testing with one prod inserted in receptacle. Notice complete visibility of scale.



Leads drawn through receptacles for overhead testing. Notice complete eye-level visibility.

HERE IS DESIGN LEADERSHIP IN ACTION...

providing the most convenient, durable, safe, versatile tester in years! Positive voltage identification. No lamps to break or burn out. Only one moving part. So compact it can be carried in pocket—so rugged it can be carried in tool box without damage. No other tester gives you so many usable features.

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS

SQUARE D COMPANY

DETROIT · MILWAUKEE · LOS ANGELES

SQUARE D COMPANY CANADA LTD., TORONTO • SQUARE D de MEXICO, S.A., MEXICO CITY, D.F.

Here's where you use

SUPER CORONOL*-GEOPRENE

Power Cable

- ***Aerial or Underground Transmission and Distribution Systems***
- ***Station and Apparatus Circuits***
- ***Mine Power Circuits***

Wherever your schedule calls for high-voltage non-metallic cable, make General Electric Super Coronol-Geoprene power cable your choice for all-round service. Where operating conditions demand exceptional resistance to ozone, heat and moisture, Super Coronol's insulation provides extra-long service life.

And, the specially compounded Geoprene jacket gives additional protection against sunlight, oils, soil acids and alkalies, and flame.

The sturdy Geoprene jacket is far tougher than any natural rubber jacket and will take mechanical abuse during and after installation. Yet, Super Coronol-Geoprene cable is lighter, more flexible than metal-clad types—is easier to handle, easier to install.

Where temperatures run high, choose Super Coronol-Geoprene cable. It permits high current-carrying capacity and small conductor sizes because of its high temperature rating.

Wherever you meet high-voltage cable applications, think first of G-E Super Coronol-Geoprene power cable.

*Registered Trade Mark of General Electric Company

Get further application and specification data from this Super Coronol-Geoprene Power Cable booklet. You'll also get test data plus splicing and terminating information. Just fill in the coupon and mail it today for your free copy.

Section W68-1018
Construction Materials Division
General Electric Company, Bridgeport 2, Conn.

Please send a free copy of the Super Coronol-Geoprene Power Cable booklet to:

Name_____ Title_____

Firm_____

Address_____

City_____ Zone____ State_____

You can put your confidence in—

GENERAL ELECTRIC